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INDIANA COLLECTION
Lakes

THE FUTURE OF THE GREAT LAKES

A Public Meeting

GREAT LAKES BASIN COMMISSION

Building a Framework
for Environmental Action

GREAT LAKES BASIN FRAMEWORK STUDY

Great Lakes Basin Commission

1972

Frederick O. Rouse
Chairman

State of Illinois
Natural Resources Development Board
State of Indiana
Department of Natural Resources
State of Michigan
Department of Natural Resources
State of Minnesota
State Planning Agency
State of New York
Department of Environmental Conservation
State of Ohio
Department of Natural Resources
Commonwealth of Pennsylvania
Department of Environmental Resources
State of Wisconsin
Department of Natural Resources

Department of Agriculture
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Department of Health, Education & Welfare
Department of Housing & Urban Development
Department of the Interior
Department of Justice
Department of State
Department of Transportation
Environmental Protection Agency
Federal Power Commission
Great Lakes Commission

Dear Great Lakes Neighbor,

The Great Lakes Basin Commission is planning means to meet people's foreseeable needs during the next 50 years. Planning for the welfare of the people in the region, their economy, and environment requires great effort on the part of government and private interests alike. You have an important planning role to play in the future of the Great Lakes. Consistent with this philosophy, you are cordially invited to express your views and concerns at a public meeting on planning alternatives in your home area. We encourage all interests to be represented and heard at these meetings.

This information packet will tell you about the Great Lakes Basin Framework Study now approaching completion. This Study is at a crucial planning stage. Although more than 450 scientists and advisors have assisted our planners, it is vital that the framework and succeeding plan reflect your concerns. Commission planners want to explain to you what they have done and are planning to do. They want and need your response.

Elsewhere in this packet are instructions on how to make statements at public meetings which are for the exchange of information rather than debate. When the Great Lakes Basin Commission completes this Study and forwards it through the Water Resources Council in Washington to the President and Congress, let it contain the results of your contribution. Please take this opportunity to help make decisions in government by reading this brochure, attending the meetings, and presenting your statement.

I look forward to meeting you and hearing from you.

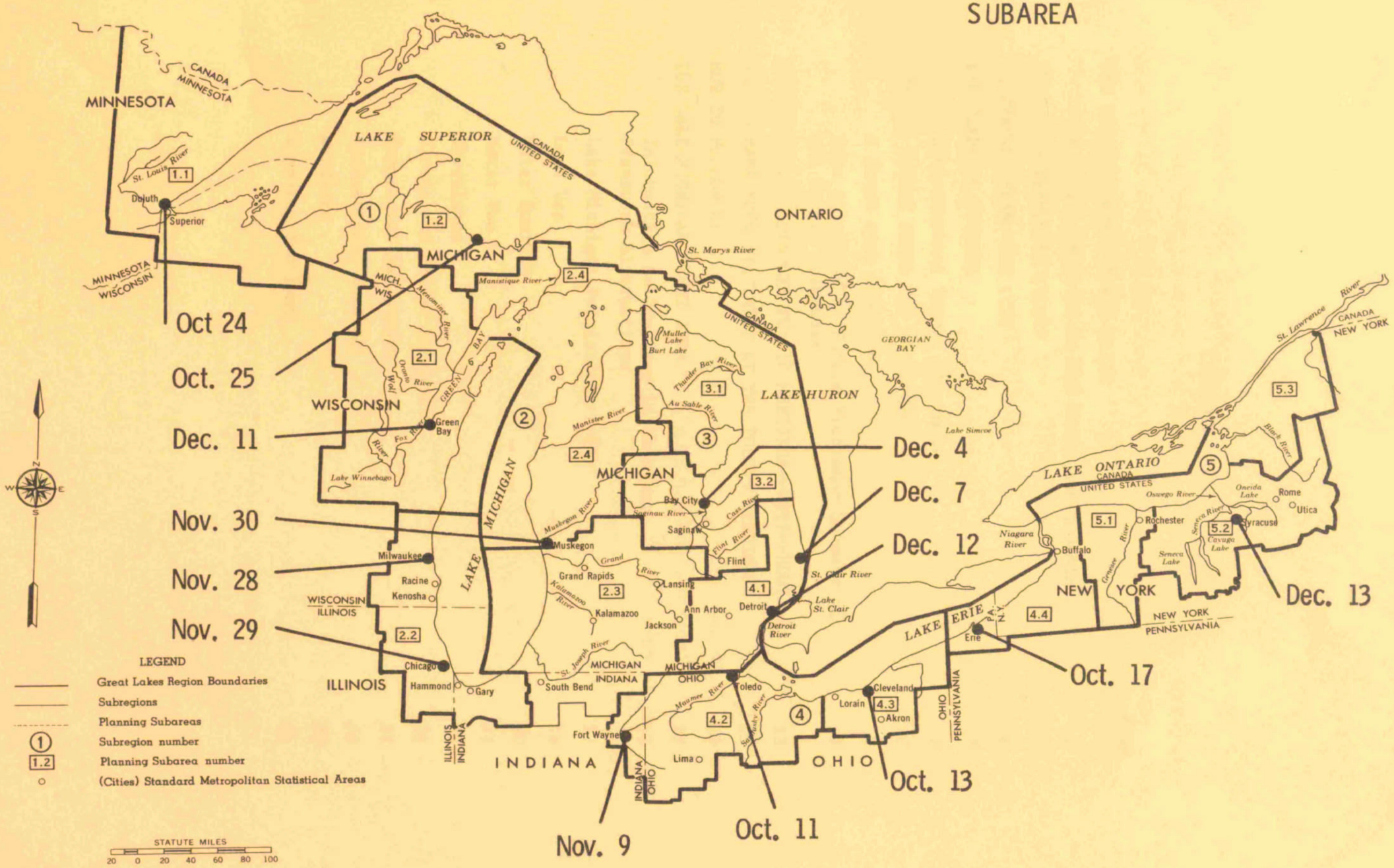
Sincerely,

Frederick O. Rouse

Frederick O. Rouse
Chairman

3475 Plymouth Road, Post Office Box 999, Ann Arbor, Michigan 48106
313/763-3590 FTS: 313/769-7431

ONE OF THESE IS YOUR PLANNING SUBAREA



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THE CHANGING GREAT LAKES BASIN

The Great Lakes Basin is unique. The Great Lakes themselves are the largest surface fresh water storage reservoirs on earth, with the exception of the polar ice caps. This is an international resource which could be spoiled, improperly managed, or given away. Without this resource, the Great Lakes Basin could not adequately support the present population or provide such a high quality of life.

The people, institutions, economy and natural resources in this Basin make it a highly desirable place to live. It represents only four percent of the land area of the United States, comprising almost the entire State of Michigan plus portions of Illinois, Indiana, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. This four percent of the nation's land area is home to 14 percent of the nation's population.

The Basin has been one of the fast growing regions in the United States. Population and economic growth projections for the Basin show there will be increased resource demands, job opportunities, income, and economic growth--as well as higher values on space, water, land, aesthetic and recreational resources in the region.

Besides providing living space, the land resources of the Basin support forestry, mineral production, food and fiber production, and recreational activities. The water resources supply the needs of people, industry, commerce, agriculture, and of power generation.

Pressing Problems in the Great Lakes Basin

Generally, water quality, not water quantity, is the major problem in the Great Lakes Basin. Quality control problems are becoming serious in areas of high population concentration like Chicago-Gary, Detroit, Cleveland, Buffalo and Duluth-Superior.

Lake Erie, Lake Ontario and southern Lake Michigan are experiencing accelerated eutrophication as a result of large quantities of nutrients entering the Lakes.

The loss of recreational beaches and fish and wildlife habitat on the Lakes, interior lakes, and streams illustrates the intensity of growing pollution problems. Waste must be controlled at its source. Additional research is required to help answer the many questions concerning the pollution problem.

The projected expansion of power facilities in the Basin causes concern over the dissipation of large quantities of heat to the waters and the atmosphere, the construction of unsightly facilities on the Great Lakes shores, and the concentration of nuclear energy sources close to population centers. The kinds and quantities of agricultural substances applied to Basin lands may create potential problems for water quality.

In addition to problems of enormous waste and inadequate waste treatment in many parts of the Basin, long-term Great Lakes level fluctuations and discharge variations are major problems. Variations of the Lake levels are minimized by regulation of Lakes Superior and Ontario. However, significant damages and lost economic opportunities arise from lake level fluctuations in all the Great Lakes. A few of these are:

- during abnormally low levels, less draft available to commercial navigation, resulting in higher shipping costs
- flow decrease in connecting channels and consequent hydroelectric power generation decrease
- fish and wildlife habitat exposed and threatened
- recreation values of water and shoreline reduced
- during abnormally high levels, flooding and erosion damage to shorelines and structures

The disposal of dredged material, some of it heavily polluted, has become a problem of large proportion. The trend toward larger commercial ships which draw more water may require the enlargement and deepening of existing harbors and channels. The completion of the St. Lawrence Seaway has greatly increased the need for dredging

while expanding the economic development opportunities for the Basin.

From the land resource viewpoint, major problems in the Great Lakes Basin are:

- lack of land and facilities to keep up with recreational demand, particularly in and near cities
- encroachment on the amount of high value agricultural land
- serious localized flooding, erosion, and sedimentation
- lack of suitable land for wildlife near urban areas

One of the most critical needs for recreation in the Basin is for high capacity day-use and weekend-use facilities inside and close to metropolitan areas. The shorelines and islands of the Great Lakes offer great opportunity for recreation, but constant vigilance is necessary to prevent industrial, commercial, and private ownership from excluding public access to the regional land and water resources.

Floods, which occur on an estimated 2.8 million acres in the Basin, create most damages in highly developed urban areas.

Based on conditions of the late 1960's, it is estimated that more than 164 million tons of solids erode from the drainage area each year. Local regions with the most critical problems include the Chicago-Milwaukee-Gary complex; southwestern Michigan-northwestern Indiana; and the Ohio-Indiana-Michigan interface. More than 50 percent of the total eroded solids comes from these three regions. Runoff must be controlled in rapidly growing urban areas of the Basin.

Land treatment is needed in the Basin to reduce runoff, erosion, and sedimentation and to improve water management. Significant land use trends in the Basin show a decline in forest land, a decline in agricultural land, and an increase in lands used for highways, power-lines, urban areas, and recreational and industrial developments.

The availability of water resources systems, transportation systems, labor, and other resources are major factors that account for

the concentrations of people and industrial growth in the Basin. In the next 50 years the population of the region is expected to nearly double. The anticipated growth pattern for the southern half of the Basin shows a vast population concentration along the Greal Lakes extending from Chicago to Detroit to Rochester. This growth could create problems of a magnitude far greater than we know now with only 29 million persons in the Basin. Congestion, social unrest, and unemployment are only some of the problems magnified by such large, intense urban concentrations.

While internal growth is projected for the southern Basin, the northern portions of the Basin may continue to have critical out-migration and a declining economy.

The number of governments and laws controlling portions of the Basin is astounding. Consequently, some of the most difficult problems facing the Basin result from the necessity of coordinating numerous levels of governmental activity at widespread locations for resource management. Canada is faced with similar problems, and yet no institution exists to place a properly integrated perspective on the numerous demands made upon the Great Lakes system. These and other problems are addressed in the Great Lakes Basin Framework Study.

WHAT IS A FRAMEWORK STUDY?

The Framework Study is a reconnaissance-type investigation that will provide broad-scale analyses of resource needs and problems. It will furnish general estimates of the probable nature, extent, timing, and costs of measures to solve problems. It will give direction on resource development choices by focusing on the impacts such choices would have on the Basin.

One of the major aims of the Framework Study is to provide useful information on our natural and human resources. Such information is needed so that rational judgments and choices can be made regarding the alternatives we face for the future well-being of the residents of

the Great Lakes Basin. Planning for an area the size of the Great Lakes Basin and for complex water and related land resources is an intricate task that requires the cooperation of many people from a variety of backgrounds. People make decisions about their resources through established institutions, both governmental and business, public and private.

Use of natural resources may mean, in some cases, development; in other cases, preservation with no development. This resources study, therefore, will consider a wide range of conditions which can be anticipated during the studied period. The study will consider the direction in which local people want their areas to grow or not grow and their objectives for increase or decrease of population, development of the economy, and the general style and quality of life. Further, the study will evaluate the potential impact of future actions upon our Canadian neighbors. The Great Lakes are a resource of international concern and responsibility.

Five years of data collection and analysis will be published in the Great Lakes Basin Framework Study, a series of 24 informational documents. When completed in 1973, the Framework Study will be an important basis for future water and land resource planning.

This Framework Study gives an assessment of

- water and related land resource capabilities
- needs arising from future economic and demographic development
- conflicts in resource use
- alternative solutions to such problems

It is important to note that the Framework Study is not designed to deal with all future changes in the character of the Great Lakes Basin. While a wide range of problems is considered in the study, The Basin Commission is not specifically directed by Federal guidelines to consider transportation, solid waste management, and air quality.

Framework study work does include evaluations of water supply in terms of sources, quantity, and quality for various uses. Land resources are evaluated in terms of land use pattern (agricultural, forest, urban, and mining), erosion problems, flood plain management, and recreational development. All of this information is presented in the Framework Study's series of 24 documents, each of which addresses a specific aspect of water or land resources.

AN OVERALL PLAN--THE CCJP

Formulation of a comprehensive, coordinated, joint plant (CCJP) for the conservation, preservation, use and development of water and related land resources in the U.S. portion of the Great Lakes Basin is a major task of the Basin Commission. The comprehensive, coordinated, joint plan (CCJP) will be a coordinated, joint system or arrangement of structural and nonstructural projects and programs. The plan will be designed to guide Federal, State, interstate, local and nongovernmental entities in the use of water and related land resources in a manner that will enhance the economic, environmental and social condition of the Great Lakes Basin. Since the Framework Study is designed to be only the first step in the development of the complex CCJP, it will not necessarily invalidate the conclusions and recommendations of more detailed regional, State, and local plans accomplished throughout the Basin.

The CCJP will require:

- specific information on many resource problems from more detailed studies (like the Southeast Wisconsin Water Resources Study; the Grand River Study, Michigan; the Erie-Niagara Study, New York; and the Genesee Study, New York)
- broad overview of resource planning and management provided by the Great Lakes Basin Framework Study. The CCJP will integrate these existing studies and future studies into a dynamic overall plan which will coordinate and document recommendations of Federal, State, local, and nongovernmental planning groups.

New studies, data collection programs, and new research will be recommended through the Framework Study and become part of the CCJP. Refined priorities for timing and funding of additional studies will also be an important part of the CCJP.

Ultimately, integrated activities of the numerous institutions involved in water and land planning will make a flexible basis for orderly growth throughout the U. S. portion of the Great Lakes Basin. Such an accomplishment should assure us and our Canadian counterparts that actions on both sides of the international border will improve our common environment.

THE PLANNING PROCESS

Planning for the use of resources is contingent on an understanding of what the future development of the Great Lakes Basin is likely to be. Accordingly, projections based on expected population size and possible economic conditions have been made for the years 1980, 2000, and 2020. The probable requirements for water and related land resources are then expressed in terms of specific resource uses, such as domestic water supplies (in millions of gallons per day); wastewater flows needing treatment (in millions of gallons per day); or water-oriented outdoor recreation opportunities to be provided (in thousands of recreation days).

Conflicts and limitations become readily apparent by comparing the demands on the resources with the water and land resource capabilities. Consequently, the Framework Study has necessarily included development programs which may solve such problems and estimation of the cost of such solutions. The program choices that are made after the public meetings will become part of a proposed framework leading eventually to the development of a comprehensive plan which will include specific program proposals. The importance of public input to the Framework Study is such that it can make a plan that people will use.

Environmental Impact Statement

Great Lakes Basin Commission plans are developed with protection of the environment in mind. An environmental impact statement will be prepared on the potential environmental effects of development programs contained in the framework finally proposed for the Great Lakes Basin. The suggestions received at the public meetings scheduled for the fall of 1972 will be incorporated into the proposed framework to the maximum practical extent. Statements from the public regarding desires for specific environmental controls in their localities are solicited as well as evaluations of the probable impacts on the environment of the frameworks presented. The contents of both the final framework proposal and impact statement will reflect this public participation.

By bringing together detailed information on water and related land resources as well as public preferences for future resource development, the Framework Study will help facilitate coordination and improve planning by Federal, State, and local agencies involved in resource management. This in turn will lead to a better future for all of us who live in the Great Lakes Basin.

MEETING FUTURE NEEDS AND PROBLEMS

The directions for growth and change in the Great Lakes Basin come from research into ideas written by scientists, philosophers, and planners about where we are and should go over the next 50 years. Objectives for planning have been ascertained from a number of sources, such as:

- national, State, and local legislation affecting water and related land resource uses
- resource planning agencies in the local, State, and Federal governments
- private interest groups
- public expression
- analysis of support for present resource trends

At this point in American history many of the basic objectives of economic expansion and environmental emphasis are under careful scrutiny both by groups which have set those objectives in the past, and by newly established groups who are prescribing new objectives for future growth patterns. Our democratic system guarantees to these many voices the right to express their choices of objectives for future development. This public participation contributes in a major manner to decision making.

A Break With Tradition

Because the Great Lakes Basin Commission encourages expression of conflicting views and objectives, instead of the usual single set of programs, it offers choices among alternative frameworks. The three alternative future objectives for the Great Lakes area are:

NORMAL GROWTH
ACCELERATED GROWTH
LIMITED GROWTH

Although most of the present work has been focused on normal growth, examples of the other two alternatives are included here for your review and reaction. Your views at public meetings on normal growth and examples of accelerated and limited growth will be recorded and used to formulate still another set of resource programs, the PROPOSED framework. After the public meetings and with the concurrence of the Great Lakes Basin Commission, the PROPOSED framework will ultimately be sent to the President and Congress. It will be used here in the Great Lakes Region as a guide for future environmental action programs.

The Framework Study is designed to be used as a dynamic planning tool. It will evaluate economic and environmental effects of a range of actions. This built-in flexibility is a necessity for making a useful plan later.

Some Solutions to Future Problems--Summary of the Normal Framework

Out of the Framework Study of alternatives for the development of the Great Lakes Basin has emerged a water and related land resource planning base called the Normal Framework. The normal framework is planned in three stages:

- Short-range plan 1970-1980
- Mid-range plan 1980-2000
- Long-range plan 2000-2020

The shorter-range programs are more definitive, but the long-range gives us a needed perspective to anticipate future resource problems and money needs. Basically, the programs use time-proven methods to resolve present and future problems economically. There are other alternatives, too. They are included for your consideration in the detailed sections that follow this summary. Among projected year 2020 programs are:

- provision of more than 112 billion gallons of safe water per day for residential, commercial, industrial, agricultural, mining, and power uses in addition to current supply
- water quality management that includes a high level of municipal and industrial wastewater treatment for nearly 16 billion gallons every day
- full support of the recommendations of the Great Lakes Water Quality Agreement between the U.S. and Canada
- prevention of about $195 million of potential urban and rural flood damages
- maintenance of 27-foot depths throughout existing harbors and channels in the Great Lakes Basin commercial navigation system
- provision for an additional 332 million recreation days and 22 million recreational boating days
- provision of land treatment and management of about 22 million acres of forest and agricultural land

- shoreline protection and management techniques for over 200 miles of Great Lakes shore.

The normal framework evaluated more than 90 structural and nonstructural programs to meet present and future needs throughout the Basin. We will be discussing some of them at our public meetings. The following table summarizes the estimated price tags of normal framework programs selected as a guide for development over the next 50 years. Normal framework programs are described for one of five Great Lakes basins in the next section of this booklet.

Great Lakes Basin

Normal Framework: Estimated Cost Summary

Framework Program Categories	Framework Cost[1] ($ millions) 1970 to 1980	2000	2020
• Water Supply	456	2278	5509[2]
• Pollution Control			
- Municipal	3168	8229	14933
• Flood Damage Prevention	541	800	910
• Outdoor Recreation			
- Water Oriented, non-boating	860	2708	5200
- Boating	447	1151	2243
• Land Conservation and Management			
- Great Lakes Shore Erosion Control	27	95	183
- Streambank Erosion Control	22	77	148
- Cropland Drainage	117	250	428
- Agricultural Land Treatment	77	244	361
- Forest Land Treatment	124	393	681
• Wildlife Management	119	343	554[3]
• Commercial Navigation	NA[4]	NA[4]	NA[4]
• Sport Fishery	51[3]	119[3]	222[3]

1/ Preliminary estimates of capital plus operation, maintenance and replacement costs

2/ For municipally supplied and rural domestic water supplies only

3/ Partial costs at this time

4/ To be available at time of public meetings

Reports on framework planning are being prepared for each of the five Lake Basins which make up the Great Lakes Basin. One of these reports has been inserted in this brochure to give you more information about the area you are most likely to know and be most concerned about. As they become available other Lake basin reports will be mailed upon request from the Commission's Public Information Office.

ALTERNATIVE FRAMEWORKS PUBLIC MEETINGS--WHY?--HOW?

The Great Lakes Basin Commission is seeking public preferences for alternative frameworks by holding a series of meetings in many cities in the Basin. We know the public will accept and use a plan built on an assessment of needs which is realistic. Only with first-hand information provided by the public in local areas can all the previously assembled scientific planning data become useful guides to action.

This series of public meetings is not the first, nor will it be the last. This series is vital, however, to producing guidelines which will eventually result in more effective planning. Continuing information exchange is essential to establish public preferences which are needed to guide plan formulation.

What meeting procedure will be used to provide information exchange between the planners and the public? State governmental agencies and local organizations concerned with the environments are assisting the Great Lakes Basin Commission in contacting you and are making practical arrangements for meeting sites. They are distributing information and in some cases are holding educational seminars to improve public understanding of the Framework Study and its alternative framework options. Local and State organizations are providing information for a mailing list of interested businesses, governments, associations, organizations, and individuals.

At each public meeting, the Great Lakes Basin Framework Study and the alternative frameworks will be described. You will be asked your opinion on (1) which particular resource problems are important, (2) how and when you want them solved, and (3) how much you are willing to pay personally to solve them. A question and answer period on material presented will follow the planners' report.

HOW TO MAKE YOUR STATEMENT AT THE PUBLIC MEETING

Formal prepared statements are preferred and will be inserted in the record. These formal statements may comment on objectives,

needs, problems, and solutions from the local or regional viewpoint and may be mailed in advance or submitted at the meeting. Oral summaries of the formal statement, of no more than five minutes' duration, may be made at the meeting. They may be submitted for the record without being read or be read aloud by those who have indicated their desire to do so when registering at the reception desk in the meeting hall. A person unable to attend the meeting and unable to send a delegate may mail the summary statement and request that it be read aloud. To conserve meeting time, the Commission encourages advance submissions which are typewritten double-spaced. Statements longer than five minutes' duration will be summarized in presentation by staff personnel. Statements will be accepted for a two week period following each meeting. Written and oral statements will receive equal consideration. Statements should identify the Lake basin of concern and may be mailed to Public Meetings, Great Lakes Basin Commission, P.O. Box 999, Ann Arbor, Michigan 48106. Questions concerning meeting procedure may be directed by telephone to Public Information Officer, Great Lakes Basin Commission, Area 313/763-3590 or 764-4427.

HOW TO FOLLOW UP

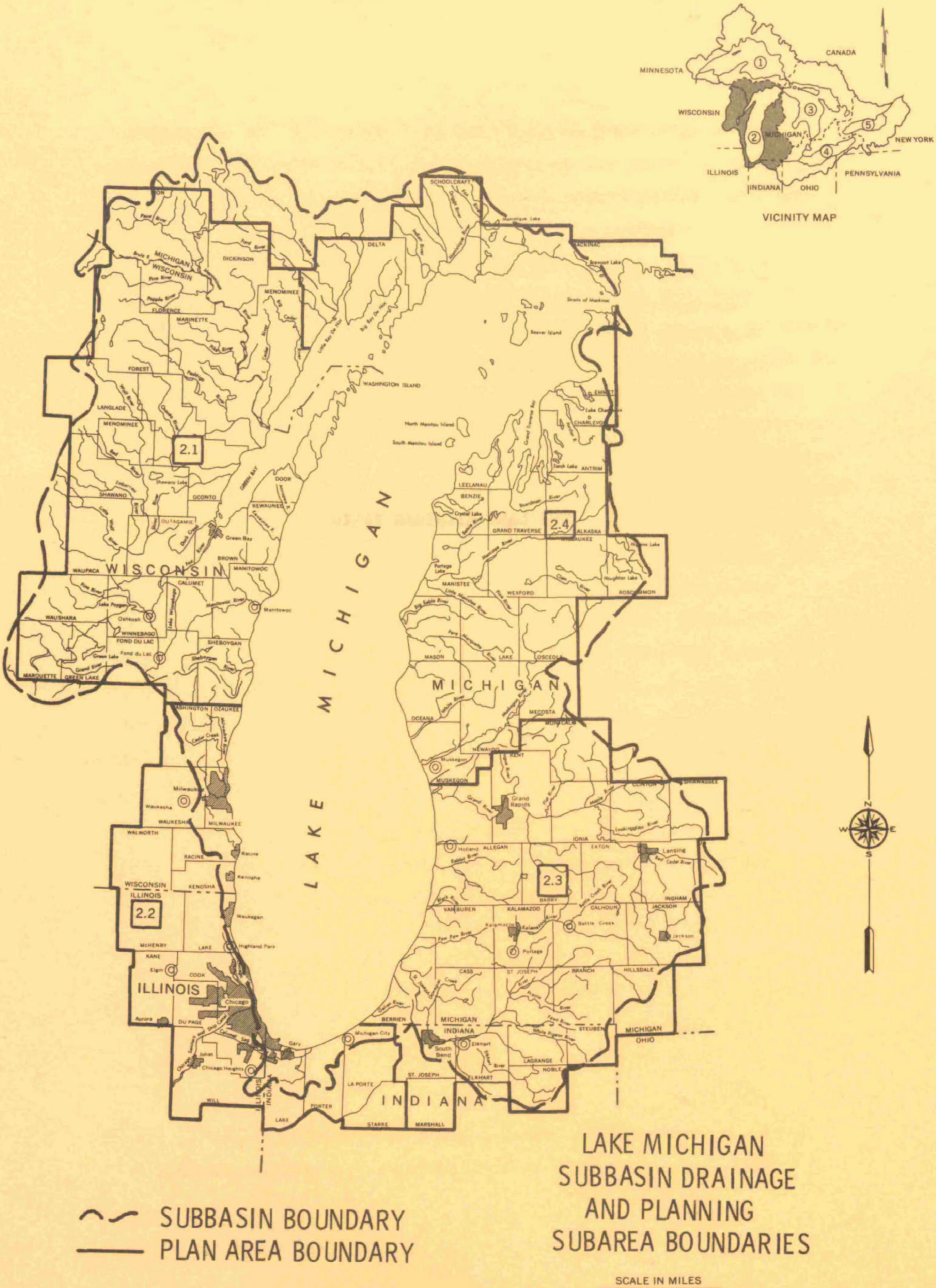
When you attend the public meeting you will be asked to fill out a card at the reception desk. In addition to indicating whether or not you wish to make a statement, the card will serve as a record from which the Commission will derive mailing information so that you may receive a summary of the public meeting you have attended. If you so request, your name will be placed on the mailing list of the Great Lakes Basin Commission to receive all future notifications of public meetings in your area as well as ongoing planning information.

If you are unable to attend a public meeting in your area but wish to receive mail related to it as well as other official

Commission publications, fill out, clip, and mail the coupon on the last page of this packet to the Commission's Public Information Office.

Your input to water and related land resource planning is always welcome. Encourage organizations to continue to consider resource needs, problems, and solutions on local Lake basin and Great Lakes system basis. Become educated in water and related land resources matters in order to recommend your solutions. If need be, form a study group, but whatever you do, foster response to and interchange with those who plan for the future.

THE LAKE MICHIGAN BASIN



LAKE MICHIGAN SUBBASIN DRAINAGE AND PLANNING SUBAREA BOUNDARIES

THE LAKE MICHIGAN STUDY AREA

Information to Consider in Choosing Framework Alternatives

Four public meetings will focus on the 67,860 square miles of land and water surface area constituting the Lake Michigan hydrologic area. Lake Michigan, shown on the map facing this page, is the only one of the five Great Lakes entirely within the United States. Some 45,560 square miles of land area, rivers, inland lakes, and embayments drain into Lake Michigan from eastern Wisconsin and Illinois, from northwestern Indiana, and from the southern and western regions of Michigan's upper and lower peninsulas, respectively. An additional 22,300 square miles of Lake Michigan are included in the hydrologic area under study. The geographical area upon which planning data is accumulated covers 50,425 square miles (32,272,400 acres) and includes 86 counties: 43 in Michigan, 6 in Illinois, 10 in Indiana, and 27 counties in Wisconsin. Despite overlap in the data bases, planning conclusions for the Lake Michigan Basin have been reached with appropriate adjustments to reflect the recently completed comprehensive study of the adjacent Upper Mississippi River Basin.

For purposes of easy reference, the Lake Michigan basin has been numbered 2.0 and has been further divided into planning subareas which are numbered 2.1, 2.2, 2.3, and 2.4.

Lake Michigan Population - Today

The population of the Lake Michigan basin as of 1970 was over 13.5 million, nearly one-half the population of the entire Great Lakes Basin. However, it should be noted that the almost 7 million people in the Illinois portion of Planning Subarea 2.2 live in the Upper Mississippi River Basin and that their demands for resources affect both basins. The frameworks were developed for both basins to avoid duplication in programming needs.

1970 POPULATION
LAKE MICHIGAN BASIN PLANNING SUBAREAS

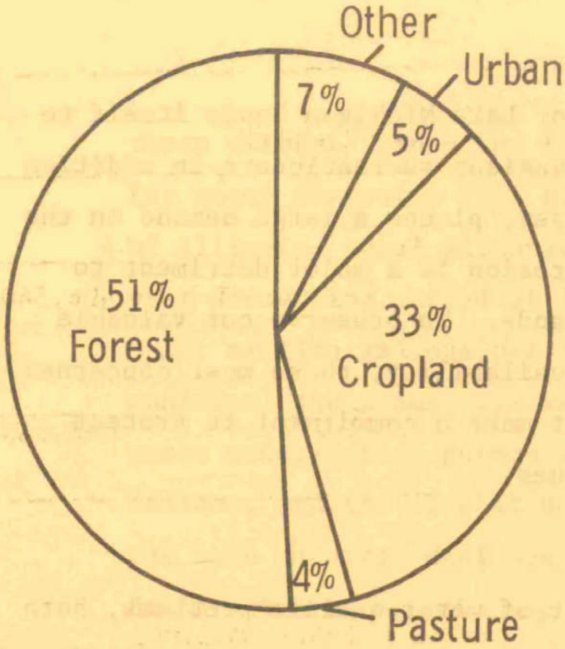
2.1		2.2		2.3		2.4	
Mich.	62,153	Ill.	6,978,947	Ind.	478,991	Mich.	496,540
Wisc.	942,870	Ind.	757,989	Mich.	2,043,588		
		Wisc.	1,755,887				
	1,005,023		9,492,823		2,522,579		496,540

In 1970, Milwaukee County, Wisconsin, and Cook County, Illinois, on the basin boundary, accounted for about 48% of the total Lake Michigan population base. Seasonal increases in population swell many recreational resorts and residences located in northern Wisconsin and Michigan.

Land Use

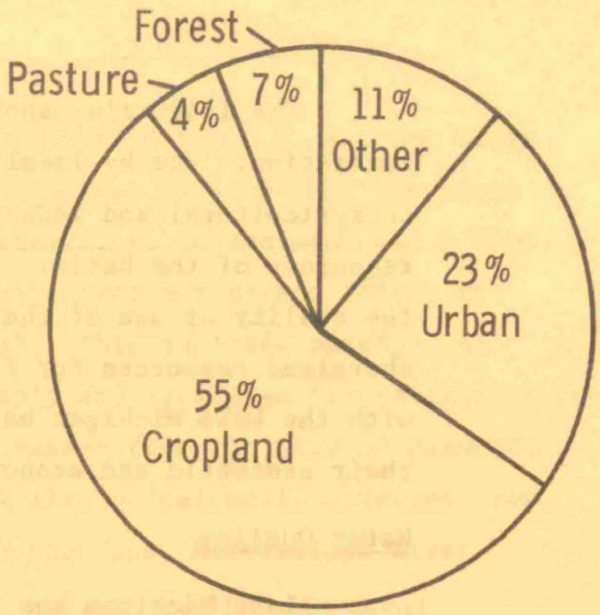
The diagrams on the next page show how Lake Michigan basin's 32,272,000 acres are presently used, giving percentages of urban buildup, cropland, pasture, forest, and other land uses. Each planning subarea has a different land use pattern. Planning Subarea 2.2, which includes the cities of Milwaukee and Chicago, has the highest percentage of urban buildup, as would be expected. Other major urban centers are Green Bay and Racine, Wisconsin; Gary-Hammond, St. Joseph-Elkhart, Indiana; and Grand Rapids, Kalamazoo, Battle Creek, and Lansing, Michigan. Over 50% of Planning Subareas 2.2 and 2.3 are devoted to cropland, while Planning Subareas 2.1 and 2.4 are more than 50% forested. Most of the cropland in Planning Subarea 2.2 is in the Upper Mississippi River Basin.

LAND USES IN LAKE MICHIGAN STUDY AREA



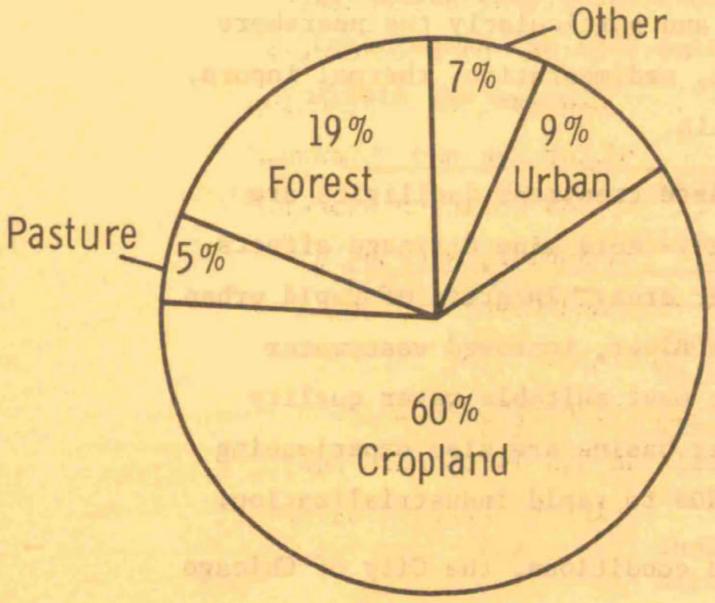
Planning Subarea 2.1
(Includes Green Bay, Appleton, Oshkosh, and Fond DuLac, Wisconsin)

Total Land Area
10,010 Acres



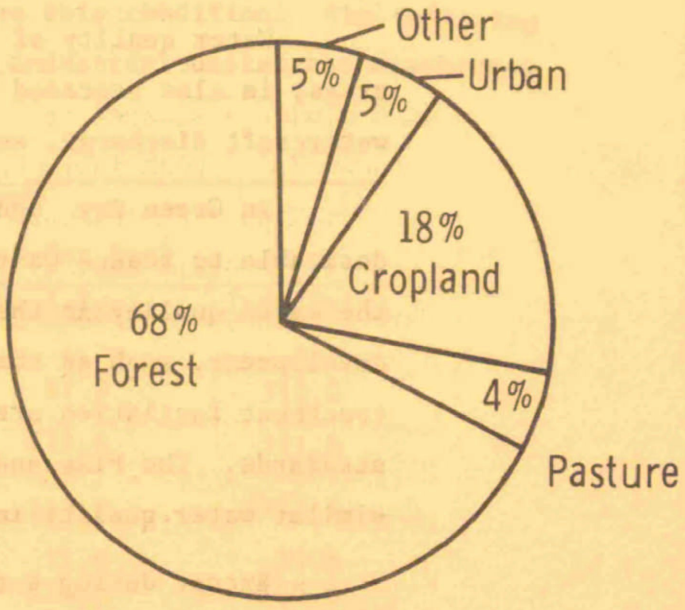
Planning Subarea 2.2
(Includes Milwaukee, Wisconsin, Chicago, Illinois, Gary and Hammond, Indiana

Total Land Area
5,212,100 Acres



Planning Subarea 2.3
(Includes Elkhart and South Bend, Indiana, Kalamazoo, Grand Rapids, and Lansing, Michigan)

Total Land Area
8,955,400 Acres



Planning Subarea 2.4
(Includes Muskegon, Traverse City, and Escanaba, Michigan)

Total Land Area
8,094,200 Acres

The 1362-mile shoreline of Lake Michigan lends itself to recreation. Use by local and transient recreationers, in addition to agricultural and industrial uses, places a large demand on the resources of the basin. Shore erosion is a major detriment to the quality of use of the shorelands. To preserve our valuable shoreland resources for future availability, those most concerned with the Lake Michigan basin must make a commitment to protect their aesthetic and economic values.

Water Quality

Lake Michigan has a number of water quality problems, both local and general. On the broader level, nutrient and total dissolved solids buildup, primarily from sewage, industrial waste, and water runoff from farm, urban, and natural lands, is accelerating the aging process of the Lake. The growth of algae from these nutrients has caused nuisance conditions in locations on the southern end of Lake Michigan. This problem can be partially relieved by adequate waste treatment facilities and programs for reduction of phosphorous in wastes from municipalities and industries.

Water quality of the Lake, and particularly the nearshore areas, is also degraded by erosion, sedimentation, thermal inputs, watercraft discharge, and oil spills.

In Green Bay additional waste treatment facilities are desirable to reduce waste discharge. Acid mine drainage affects the water quality in the Iron River area. In areas of rapid urban development, such as the Lower Fox River, improved wastewater treatment facilities are needed to meet suitable water quality standards. The Pike and Root River basins are also experiencing similar water quality impairment due to rapid industrialization.

Except during extreme flood conditions, the City of Chicago and State of Illinois are diverting the natural drainage from about 810 square miles of the Lake Michigan basin into the Illinois River to keep from burdening the Lake with the waste contents of

those waters. Under the limitations set by the U.S. Supreme Court for water diversion from the Lake Michigan watershed by the State of Illinois, total withdrawal is limited to an average over a five year accounting period of 3,200 cubic feet per second (cfs), or 2,068 million gallons per day (mgd). This includes pumpage for municipal and industrial water supply and diversion for navigation and waste assimilation purposes. Wastewater from the City of Hammond, Indiana, and the area it serves is also occasionally diverted from the Lake Michigan drainage area to the Upper Mississippi River Basin. Milwaukee, Wisconsin, serves areas outside the Great Lakes Basin with Lake Michigan water, but discharges the treated wastewater effluents back into Lake Michigan.

Installation of chlorination facilities in the Elkhart-South Bend area of the St. Joseph River in Indiana has corrected previous bacteriological pollution. The drainage from various rivers into the Grand Traverse Bay has had an adverse effect on the water quality of that area, and several municipalities are installing facilities to improve this condition. The following table shows the 1970 municipal and industrial wastewater discharges within the basin.

WASTEWATER FLOWS

(Millions of Gallons Per Day)

Planning Subarea	State	Municipal	Industrial
2.1	Michigan	4.7	9.0
	Wisconsin	87.7	310.0
2.2	Wisconsin	211.1	321.0
	Illinois	--	--
	Indiana	113.6	2953.0
2.3	Indiana	71.9	25.8
	Michigan	170.0	220.0
2.4	Michigan	27.0	82.3
2.0	4 States	686.0	3921.1

Water Use

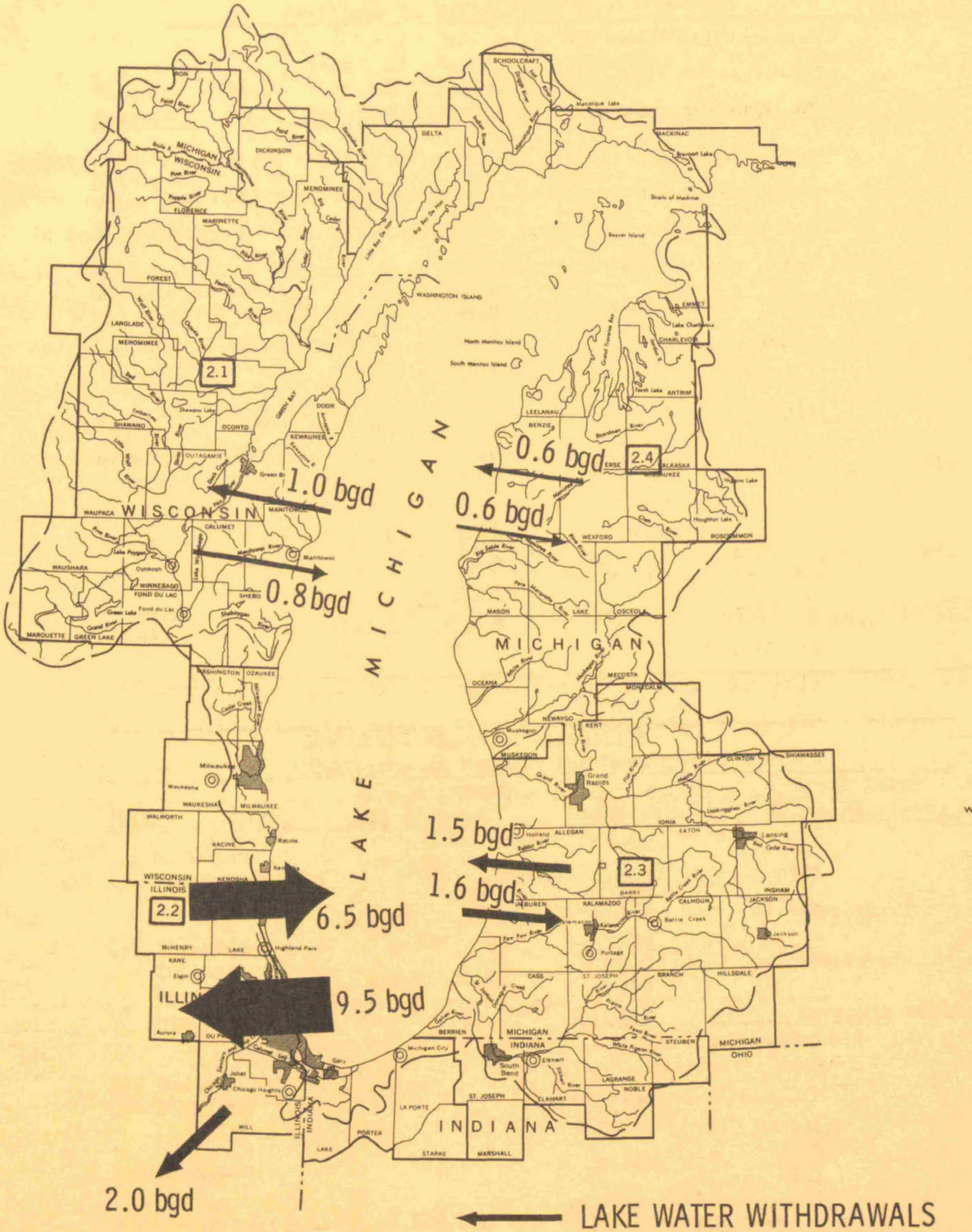
Municipal, industrial and agricultural water use in the Lake Michigan basin are shown on the next page. The following page illustrates water withdrawn and water discharged to Lake Michigan by planning subarea.

Lake Michigan is the principal source of self-supplied industrial water for large water-using manufacturing establishments along the lakefront. The water use table shows the tremendous amount of water used by Indiana and Illinois in Planning Subarea 2.2 for industrial use and that Illinois also requires a significantly large quantity of water for municipal use. Much of the industrial water is withdrawn for cooling purposes. Heated water discharged into Lake Michigan is an important topic to many groups concerned with the well-being of the Lake ecosystem. Stringent control of temperature differentials encourages the installation of facilities to cool the waters before they are discharged. As of December 31, 1970, the 54 electric power generation plants of 10 megawatts capacity or more within the Lake Michigan Basin included 34 thermal, 8 gas turbine, 5 hydroelectric, 5 internal combustion, and 2 nuclear electric plants. Scheduled plants with a total capacity of 9,535 megawatts consisted of one pump storage (1,872 megawatts), six nuclear electric plants (6,948 megawatts), two steam plants (681 megawatts), and one gas turbine plant (34 megawatts). Virtually all condenser cooling systems operating in 1970 were of the flow-through type as constrasted to those with a supplemental cooling system, such as cooling towers or ponds. The basin's electrical power development is shown in the following table.

ELECTRIC POWER DEVELOPMENT

Planning Subarea	Hydro-electric (mw)	Internal Combustion (mw)	Fossil Steam (mw)	Nuclear Steam (mw)	Total (mw)	Steam Electric Water Withdrawal (mgd)
2.1	150	47	989	524	1,710	669
2.2	-	283	6,125	-	6,408	3,208
2.3	36	217	2,116	-	2,369	1,079
2.4	87	67	616	75	845	471
2.0	273	614	9,846	599	11,332	5,428

LAKE MICHIGAN USE - 1970
A SOURCE AND A SINK



LAKE MICHIGAN WATER RESOURCES NOW IN USE
(Millions of Gallons Per Day)

Planning Subarea	Municipal	Self Supplied Industrial	Rural Domes. & Livestock	Irrigation Including Golf Courses	Mining	Thermal Power Cooling	Total
2.1							
Michigan	5.1	9	9.0				
Wisconsin	87.7	311	38.5				
Subtotal	92.8	320	47.5	18.8	2.2	669.2	1150.5
2.2							
Wisconsin	211.1	257.6	28.1				
Illinois	1337.0	1348	39.8				
Indiana	96.8	3184	19.7				
Subtotal	1645.0	4753.6	87.6	23.0	16.0	3208.7	9733.9
2.3							
Indiana	45.2	29	14.5				
Michigan	220.7	245	67.8				
Subtotal	265.9	274	82.3	37.5	10.9	1079	1749.6
2.4							
Michigan	39.1	89.6	16.8				
Subtotal	39.1	89.6	16.8	13.7	4.4	471.3	634.9
2.0 Total	2042.8	5437.2	234.2	93.0	33.5	5428.2	13268.9

REMAINING RESOURCE CAPABILITY
(Millions of Gallons Per Day)

Planning Subarea	Inland Lakes and Streams	Groundwater	Great Lakes (Lake Michigan)
2.1 Michigan	1,333	920	
Wisconsin		2,960	
		3,880	(Greatly in
2.2 Illinois	Not	90	
Indiana	significant	110	excess of
Wisconsin		250	
Michigan		40	forecast needs)
		490	
2.3 Indiana	4,071	550	
Michigan		2,300	
		2,850	
2.4 Michigan	842	4,490	
2.0 (four states)	6,246	11,710	

Although the historical rate of growth of energy requirements is projected to taper off in the future, the output in many industries is closely correlated with the amount of energy used per worker. Increases in the standard of living have likewise been closely associated with energy used per person. As families are able to afford more luxuries, they increase their demands on the energy supply. Electric cooking, air conditioning and space heating are large power consumers while electric can openers, carving knives, toothbrushes, and electric power home tools do not individually place high demands on electric energy. However, the public's continuing demand for electrical amenities will require provisions to meet the demands.

Shorelands

Shorelands are classified on a basis of 10 shore types, of which Lake Michigan has many. Lake Michigan shorelands provide the greatest number of recreation shoreland miles of any U.S. portion of the Great Lakes, with approximately one-half of the total designated recreation miles of the Great Lakes Basin.

Three hundred fifty miles (26%) of Lake Michigan shoreline are forested or in woodland use. This is characteristic of the northern portion of the basin. Although the beauty of these forested lands adds greatly to their aesthetic value, developed access to this area is much less than in the southern section of the basin.

Sandy beaches and dunes, especially on the eastern shores of the Lake, present exceptional recreation opportunities. With the exception of a certain few areas, good water quality enhances the water-based recreation of the area.

Two hundred forty-five miles (18%) of shoreland are publicly owned, 156 miles of which are Federal, State, and local parks. Most of the shoreline of Chicago is open to public recreation use. Specific areas of interest include Indiana Dunes National Lakeshore, various State parks, and Sleeping Bear Dunes National Lakeshore.

Commercial and industrial development is limited to the south and west portions of the Lake. South of a line connecting Manistee, Michigan, and Sturgeon Bay, Wisconsin, residential areas predominate, with agricultural and forest developments to the northward.

Erosion is a major detriment to the quality and use of the shorelands. Major causes of this problem are wave action, underground water seepage, frost and ice action, and surface water runoff. The following table, prepared before the recent increased erosion, summarizes the extent of erosion problems along the Lake Michigan shoreline.

LAKE MICHIGAN SHORELINE CONDITIONS, 1970

Planning Subarea	State	Miles of Shoreline	Erosion Miles		
			Critical	Noncritical	Protected
2.1	Michigan	39.0	0	38.9	0
	Wisconsin	326.5	0	110.7	20.4
2.2	Wisconsin	80.5	26.0	35.6	18.9
	Illinois	65.0	10.5	0	54.5
	Indiana	45.0	13.0	9.6	22.4
2.3	Indiana	-	-	-	-
	Michigan	107.9	38.6	68.2	1.1
2.4	Michigan	698.1	42.0	194.3	44.7
2.0	4 States	1,362.0	130.1	457.3	162.0

Floods and Dollar Damages

Improper land use and management can result in unnecessary and costly flood damages to homes, property, services, and industrial and agricultural production. Flooding may occur at any time, generally as a result of rain and/or snow melt, with the most damaging floods in late winter or early spring.

The following table indicates average annual flood damages in dollars and acres damaged in the various planning areas of the Lake Michigan basin under 1970 economic conditions and developmental levels.

ESTIMATED (1970) FLOOD DAMAGE, LAKE MICHIGAN SUBBASIN

Planning Subarea	State	Estimated Average Annual Damage ($)		Estimated Acres in Flood Plain	
		Urban	Rural	Urban	Rural
2.1	Michigan	138,560	20,056	501	40,788
	Wisconsin	2,179,550	1,171,006	12,971	600,932
2.2	Wisconsin	280,500	191,650	2,198	54,386
	Illinois	---	---	---	---
	Indiana	8,419,180	38,700	2,200	3,865
2.3	Indiana	397,800	28,000	3,413	14,956
	Michigan	2,542,830	1,957,590	46,222	265,771
2.4	Michigan	98,800	147,132	3,235	112,592
2.0	4 States	14,057,220	3,559,134	70,740	1,093,290

Although the basin suffers $3.6 million and $14.1 million in average annual damages in rural and urban areas respectively, relatively little reduction in total losses has occurred as a result of past flood prevention measures. Flood prevention projects reduce losses, but continued development in flood plains increases total losses. In some cases it is startling to note that many small dams built on a local or private basis do little to alleviate flood damages and in some areas actually contribute to flood stages. Some flood plain legislation has been developed to regulate development of flood plains, but it is apparent that more effective management and construction is warranted.

Commercial Navigation

The economic well-being of the Great Lakes is directly related to the efficiency of waterborne commerce. Major commodities transported in the Lake Michigan basin include coal, fuel oil, cement, lumber, paper, grain, iron ore, petroleum products, sand, and gravel. Major harbors include Green Bay, Manitowoc, Kewaunee, Port Washington, Milwaukee, Oak Creek, Chicago, Calumet, Indiana, Buffington, Gary,

Burns Waterway, Grand Haven, Holland, South Haven, St. Joseph, Muskegon, Ludington, Manistee, Portage Lake, Frankfort, Charlevoix, Escanaba, Port Inland, and Port Dolomite. The economy of these port areas is highly dependent upon this commerce.

The Port of Chicago (Chicago and Calumet Harbors) is the major overseas cargo port in the Great Lakes. However, Milwaukee and other ports have provided for future growth in navigation and equipped themselves with facilities to accommodate such growth. Priorities in many areas are: extension of the season, port promotion, and expansion. Strong port promotional policies and favorable action to reduce discriminatory rail rates could substantially increase the area's share of grain exports and general cargo.

Three private harbors in Michigan, two in Indiana, and one in Wisconsin accommodate transport of coal, limestone, cement, and iron ore. Total traffic carried was 138 million tons in the Lake Michigan basin in 1968.

Recreational Boating

There has been a dramatic increase in recreational boating which has become an important factor in the use of Lake Michigan's resources. The general trend is toward more leisure time, and outboard motors with higher horse power have become increasingly available, which permit boaters to use more of the Lake surface. The Great Lakes Region, with 14.8 percent of the nation's population, has 17.3 percent of the nation's registered boats. Boating is a major recreational activity in the Lake Michigan basin. Fishing is the primary intent of boaters, with cruising and water skiing closely behind. The following table will indicate by planning subarea the number of registered boats and registered boats per thousand population in 1968:

Planning Subarea	Population (1,000)	No. of Registered Boats (1,000)	No. of Registered Boats Per 1,000 Population
2.1	948.0	58	61
2.2	9,094.7	150	16
2.3	2,393.8	142	59
2.4	464.8	47	101
2.0	12,901.3	397	31

Planning Subarea 2.4 experiences a lower population but a higher ratio of boats per 1,000 persons. This can be attributed to the many inland lakes located reasonably near the population. Muskegon County registers more boats than any other county in the area, 8,982.

Sport fishing draws a large number of recreational boats to Lake Michigan. The northern portion of the basin provides northern pike, walleyes, large and small mouth bass, trout, and muskellunge fishing. Other species include catfish, rock bass, white bass, sheepshead, carp, bowfin, and gar. Since the introduction of the coho and chinook salmon, these species have provided exciting experiences for the avid fisherman. Specimens weighing up to 43 pounds have been caught.

Wildlife

Lake Michigan's northern forests provide habitat for the black bear, snowshoe hare, grouse, bob cat, lynx, and other fur bearers, including otter, fisher, beaver, mink, muskrat, and pine martin. The forest cover and soils change, proceeding southward, as does the selection of wildlife the land supports. In the southerly areas, farm game such as pheasant, cottontail rabbit, gray and fox squirrel dominate. Whitetail deer and black bear provide hunters opportunities for bigger game in the northern section of the Michigan Basin.

Planning Subareas 2.1 and 2.4 support several endangered species of wildlife, including the bald eagle, the timber wolf, the arctic peregrine falcon, and the Kirtlands warbler. The forested and agricultural lands are especially conducive to wildlife habitat and provide a nearby sampling of wildlife activity.

Through man's endeavors to civilize his environment he has inadvertantly disrupted the normal activities of many wildlife species. While urbanization is crowding out fur-bearers in some areas, increases in population of other species follow with adaptation to man's remodeling of the environment.

The table on the following page indicates the location and primary uses of wildlife refuges in the Lake Michigan Basin.

Seney Wildlife Refuge, noted for its waterfowl, is Lake Michigan basin's largest.

The Lake Michigan basin ranks second to Lake Huron basin in wetland acres. These wetlands are the most important wildlife habitat in the Great Lakes Basin.

WILDLIFE REFUGES OF LAKE MICHIGAN BASIN

Refuge	State	Uses	Total Acres of Habitat
Horicon	Wisconsin	waterfowl	20,836
Gravel Island, Green Bay	Wisconsin	heron, gull, caspian terns	29
Seney	Michigan	waterfowl	95,455
Michigan Islands	Michigan (Charlevoix)	heron, gull, terns	363
			116,683

Resource Problems

In order to be corrected, problems must be defined, placed in proper perspective, and, if possible, solutions should be formulated in order of priority ranking. In the Lake Michigan basin proper the following items should be of major concern and recognition given to their potential severity.

- Municipal wastewater discharge
- Industrial wastewater discharge
- Land use
- Shoreland erosion

More specifically, in the Northwest Lake Michigan basin, Planning Subarea 2.1, the following conditions are potentially severe:

- Menomenee Complex
  - water oriented outdoor recreation
  - land use
- Menominee River Basin
  - land use
  - agricultural land treatment
  - streambank erosion
- Peshtigo River Basin
  - industrial wastewater discharges
  - land use
  - streambank erosion
- Oconto River Basin
  - land use
- Suamico Complex
  - industrial wastewater discharges
- Fox River Basin
  - municipal wastewater discharges
  - industrial wastewater discharges
  - sport fishing
  - land use
  - flood plains

- Pensaukee Complex
  - land use
- Sheboygan, Green Bay Complex
  - municipal wastewater discharges
  - industrial wastewater discharges
  - land use

In the Southwest portion of the Basin, Planning Subarea 2.2, problems with a potential future severity are:

Chicago, Milwaukee Complex

- self supplied industrial water withdrawals
- thermal cooling water withdrawals
- municipal wastewater discharges
- flood plains
- recreational boating
- aesthetic and cultural values

In that same complex several conditions demand immediate attention:

- municipally supplied water withdrawals
- industrial wastewater discharges
- flood plains
- water oriented outdoor recreation
- sport fishing
- land use
- recreational boating

Southeast portions of the Basin with potentially severe conditions are:

- St. Joseph Basin
  - municipal wastewater discharges
  - industrial wastewater discharges
  - recreation boating
- Black River
  - sport fishing
  - recreation boating
  - land use (also in some areas in need of immediate attention)
  - shoreland erosion (immediate attention required)
- Ottawa Complex
  - recreational boating
  - land use
  - cropland drainage
  - shoreland erosion
- Grand River Basin
  - irrigation
  - municipal wastewater discharges
  - industrial wastewater discharges
  - water oriented outdoor recreation
  - sport fishing
  - recreation boating
  - land use
  - agricultural land treatment
  - cropland drainage
  - flood plains
  - wildlife management
  - outdoor recreation

- Kalamazoo River Basin
  - irrigation
  - municipal wastewater discharges
  - industrial wastewater discharges
  - water oriented outdoor recreation
  - sport fishing
  - recreational boating
  - land use (some areas immediate attention required)

The Northeast Lake Michigan basin faces potential future problems in the following areas:

- Muskegon River Basin
  - hydroelectric power
  - forest land treatment
  - shoreline erosion
  - land use
- Sable Complex
  - shoreland erosion
  - land use
- Manistee River Complex
  - mining
  - land use
  - shoreland erosion
  - streambank erosion
- Traverse Complex
  - municipal wastewater discharges
  - industrial wastewater discharges
  - land use
- Seul Choix Groscop Complex
  - outdoor recreation
- Manistique Complex
  - cropland drainage
  - flood plains
- Bay de Noc Complex
  - land use
  - flood plains
- Escanaba River Basin
  - industrial wastewater discharges
  - streambank erosion

These conditions indicate an urgent need for land use management in all areas. Wastewater treatment and erosion prevention for shorelines and streambanks are also of concern.

The resources problems matrix for the basin is shown on the following two pages. Lake Michigan basin resources can be used advantageously or not used. They can be depleted or destroyed, or they can enhance the economy and social well-being and affect the quality of life style.

RESOURCES PROBLEMS MATRIX, LAKE MICHIGAN SUBBASIN

Geographical Area / Resource Problem Category

Lake Michigan Subbasin 2.0

Lake Michigan Northwest River Basin Group 2.1

Resource Problem Category	Open Green Bay Waters	Open Lake Michigan Waters	Menominee Complex: Urban-Ind.-Towns-Seasonal People Concentrations	Menominee Complex: Rural	Menominee Complex: Lake Michigan Interface	Menominee River Basin: Urban-Ind.-Towns-Seasonal People Concentrations	Menominee River Basin: Rural	Menominee River Basin: Lake Michigan Interface	Peshtigo River Basin: Urban-Ind.-Towns-Seasonal People Concentrations	Peshtigo River Basin: Rural	Peshtigo River Basin: Lake Michigan Interface	Pensaukee Complex: Urban-Ind.-Towns-Seasonal People Concentrations	Pensaukee Complex: Rural	Pensaukee Complex: Lake Michigan Interface	Oconto River Basin: Urban-Ind.-Towns-Seasonal People Concentrations	Oconto River Basin: Rural	Oconto River Basin: Lake Michigan Interface	Saumico Complex: Urban-Ind.-Towns-Seasonal People Concentrations	Saumico Complex: Rural	Saumico Complex: Lake Michigan Interface	Fox River Basin: Urban-Ind.-Towns-Seasonal People Concentrations	Fox River Basin: Rural	Fox River Basin: Lake Michigan Interface	Cheboygan Greenbay Complex: Urban-Ind.-Towns-Seasonal People Concentrations	Cheboygan Greenbay Complex: Rural	Cheboygan Greenbay Complex: Lake Michigan Interface
WATER WITHDRAWALS: Municipally Supplied	1																				1			1		
WATER WITHDRAWALS: Self-Supplied Industrial	1																							1		1
WATER WITHDRAWALS: Rural Domestic & Livestock	1							1			1											1			1	
WATER WITHDRAWALS: Irrigation	1	1			1			1			1						1					1			1	1
WATER WITHDRAWALS: Mining	1																									
WATER WITHDRAWALS: Thermal Power Cooling	1							1																		
NON-WITHDRAWAL WATER USES: Mun. Wastewater Discharge	2	2	1		1			1			1						1			1		2			2		
NON-WITHDRAWAL WATER USES: Ind. Wastewater Discharge	2	2	1		1			1			2						1			2					2		
NON-WITHDRAWAL WATER USES: Hydroelectric Power	1									1												1				
NON-WITHDRAWAL WATER USES: W.O. Outdoor Recreation	2	1	1				2			1			1									1	1				
NON-WITHDRAWAL WATER USES: Sport Fishing	1		1	1																	2			2		
NON-WITHDRAWAL WATER USES: Recreational Boating	1	1		1	1																1	1	1	1	1	2
NON-WITHDRAWAL WATER USES: Commercial Fishing	1		1	1																						
NON-WITHDRAWAL WATER USES: Commercial Navigation	1	1				1	1										1								1	1
RELATED LAND USES AND PROBLEMS: Land Use	2	2					2		1	2		2	1		2	1		2	1		1	2	1	1	2	2
RELATED LAND USES AND PROBLEMS: Ag. Land Treatment	1	2				1			2			1						1				2			1	
RELATED LAND USES AND PROBLEMS: Cropland Drainage	1	2				1			1			1			1			1				1			1	
RELATED LAND USES AND PROBLEMS: Forest Land Treatment	2	1				1			1			1			1										1	
RELATED LAND USES AND PROBLEMS: Shoreland Erosion	2	1			1			1																1		2
RELATED LAND USES AND PROBLEMS: Stream-bank Erosion	1	2			1			2			2			1			1			1		2			1	
RELATED LAND USES AND PROBLEMS: Flood - U. Plains - R.	1	1				1	1		1	1	1		1		1	1			1		2	2	1	1		
RELATED LAND USES AND PROBLEMS: Wildlife Management	1	1			1			1			1			1			1		1		1	1			1	
RELATED LAND USES AND PROBLEMS: Aesthetic and Cultural	1	1	1		1			1			1			1			1			1	1	1	1	1		
RELATED LAND USES AND PROBLEMS: Outdoor Rec. Int.-- Ext.	1	1					2			1			1									1	1			

Lake Michigan Northwest River Basin Group 2.1 (continued) / L. Mich.-SW River Basin Group 2.2

Resource Problem Category	Cheboygan Greenbay Complex: Lake Michigan Interface	Open Lake Michigan Waters	Chicago Milwaukee Complex: Urban-Ind.-Towns-Seasonal People Concentrations	Chicago Milwaukee Complex: Rural	Chicago Milwaukee Complex: Lake Michigan Interface
WATER WITHDRAWALS: Municipally Supplied		2	3		1
WATER WITHDRAWALS: Self-Supplied Industrial		1	2		1
WATER WITHDRAWALS: Rural Domestic & Livestock		1		2	
WATER WITHDRAWALS: Irrigation					
WATER WITHDRAWALS: Mining		1	1	2	
WATER WITHDRAWALS: Thermal Power Cooling		1	2	1	1
NON-WITHDRAWAL WATER USES: Mun. Wastewater Discharge		1	2		1
NON-WITHDRAWAL WATER USES: Ind. Wastewater Discharge		2	3		1
NON-WITHDRAWAL WATER USES: Hydroelectric Power					
NON-WITHDRAWAL WATER USES: W.O. Outdoor Recreation		2	3	2	3
NON-WITHDRAWAL WATER USES: Sport Fishing		2	3	2	2
NON-WITHDRAWAL WATER USES: Recreational Boating	2	2	2	2	3
NON-WITHDRAWAL WATER USES: Commercial Fishing		1			
NON-WITHDRAWAL WATER USES: Commercial Navigation	1	1	1		1
RELATED LAND USES AND PROBLEMS: Land Use	3	3	3	3	3
RELATED LAND USES AND PROBLEMS: Ag. Land Treatment				1	
RELATED LAND USES AND PROBLEMS: Cropland Drainage		1		1	
RELATED LAND USES AND PROBLEMS: Forest Land Treatment				1	
RELATED LAND USES AND PROBLEMS: Shoreland Erosion	1	2			2
RELATED LAND USES AND PROBLEMS: Stream-bank Erosion		1		1	
RELATED LAND USES AND PROBLEMS: Flood - U. Plains - R.		1	2	1	
RELATED LAND USES AND PROBLEMS: Wildlife Management		2	1	3	2
RELATED LAND USES AND PROBLEMS: Aesthetic and Cultural	1	2	2	2	2
RELATED LAND USES AND PROBLEMS: Outdoor Rec. Int.-- Ext.		2	2	2	2

Legend:
3 = Severe -- Demands immediate attention
2 = Moderate -- Of major concern; potentially serious
1 = Minor -- Not considered a serious problem
Blank = Insignificant Problem

TABLE ___

RESOURCES PROBLEMS MATRIX, LAKE MICHIGAN SUBBASIN (continued)

Sheet 2 of 2
Time Level 1970
Date July, 1972

	Geographical Area / Resource Problem Category	Lake Michigan Subbasin 2.0	Lake Michigan Southeast River Basin Group 2.3																	Lake Michigan Northeast River Basin Group 2.4																									
					St. Joseph R. Basin			Black River Complex			Kalamazoo River Basin			Ottawa Complex			Grand River Basin					Muskegon River Basin			Sable Complex			Manistee River Complex			Traverse Complex			SeulChoix Croscop Complex			Manistique River Complex			BaydeNoc Complex			Escanaba River Basin		
				Open Lake Michigan Waters	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface		Open Lake Michigan Waters	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface	Urban-Ind.-Towns-Seasonal -- People Concentrations	Rural	Lake Michigan Interface
WATER WITHDRAWALS	Municipally Supplied	1	1									1							1	1										1															
WATER WITHDRAWALS	Self-Supplied Industrial	1	1		1		1												1	1										1											1		1			
WATER WITHDRAWALS	Rural Domestic & Livestock	1	1		1	1			1						1		1	1		1			1			1																				
WATER WITHDRAWALS	Irrigation	1	1				1	1	1	1	2	2						2																												
WATER WITHDRAWALS	Mining	1	1		1					1	1						1			1																						1			1	
WATER WITHDRAWALS	Thermal Power Cooling	1	1						1	1	1	1								1			1						2																	
NON-WITHDRAWAL WATER USES	Mun. Wastewater Discharge	1	2	2	2		1	1		2	2		1	2		2	2			1		1						1			2						1			1			1		
NON-WITHDRAWAL WATER USES	Ind. Wastewater Discharge	1	2		2						2						2			1		1									2									1			2		
NON-WITHDRAWAL WATER USES	Hydroelectric Power	1	1		1	1						1					1	1		1		2	1																						
NON-WITHDRAWAL WATER USES	W.O. Outdoor Recreation	1	1		1	1	1	1	1	1	2	2	1	1	1	1	2	1		1		1										1				2						1			
NON-WITHDRAWAL WATER USES	Sport Fishing	1	2	1	1	1		1	2		2	2		1	1		2	2	1	1		1			1															1					
NON-WITHDRAWAL WATER USES	Recreational Boating	1	2	1	2	2	1		1	2	2	1			1	2	2	1	1	1	1			1			1			1			1			1			1			1			1
NON-WITHDRAWAL WATER USES	Commercial Fishing	1	1	1																1	1																								
NON-WITHDRAWAL WATER USES	Commercial Navigation	1	1		1		1										1		1	1											1		1										1		1
RELATED LAND USES AND PROBLEMS	Land Use	2	2		1	2	1		3	3		2	1		2	3	1	2	1	2			3	3		3	3		2	2		2	2		1	1		1	1			2	1	1	1
RELATED LAND USES AND PROBLEMS	Ag. Land Treatment	1	2			2			1			1			1			2		1			2			1			1															1	
RELATED LAND USES AND PROBLEMS	Cropland Drainage	1	1			1			2			1			2			2		1			1													1			2			1			1	
RELATED LAND USES AND PROBLEMS	Forest Land Treatment	1	1												1			1		1			1			1			1			2			1			1			1			1	
RELATED LAND USES AND PROBLEMS	Shoreland Erosion	2	2				2			3			1			1			1	2				2			2			2			1			1									
RELATED LAND USES AND PROBLEMS	Stream-bank Erosion	1	2			2			1			2			1			2		1			2			1			2									1						2	
RELATED LAND USES AND PROBLEMS	Flood -U. Plains -R.	1	1		1	2		1			1	2		1			2	2		1																				2			2			
RELATED LAND USES AND PROBLEMS	Wildlife Management	1	1		1	2			1		1	1			1		1	2		1		1	1			1			1			1			1			1			1			1	
RELATED LAND USES AND PROBLEMS	Aesthetic and Cultural	1	1	1	1	1	2	1		1	1		1	1		1	1		1	1		1		1	1			1		1	1								1				1		1
RELATED LAND USES AND PROBLEMS	Outdoor Rec. Int.--Ext.	1	1		1	1	1	1	1	1	2	2	1	1	1	1	2	1		1		1										1				2						1			

Legend:
3 = Severe -- Demands immediate attention
2 = Moderate -- Of major concern; potentially serious
1 = Minor -- Not considered a serious problem
Blank = Insignificant Problem

ALTERNATIVE FUTURES

In order to consider alternative futures for the Great Lakes Basin, Commission planners for water and related land resources first need to know the goals and objectives of the residents in each individual Lake basin. They need to know the public's goals and aspirations for social, economic, and environmental well-being.

What are the Alternative Goals and Objectives for Lake Michigan Basin?

The Framework Study will attempt to answer this question. The answers will be derived from official Federal, State, and local government information, through professional discussions, the reading of numerous research reports, observation of statements in the press, and listening at public meetings.

From the national perspective, planners are admonished:

- to enhance national economic development by increasing the Nation's output of goods and services
- to help reduce unemployment and underemployment to what are considered full employment levels
- not to expect increased allocation of funds for the Great Lakes Basin's water and related land resources development
- to select programs and criteria which maximize net beneficial effects, considering social benefits, costs, and all intangible values in addition to quantifiable benefits and costs

What Are Your Goals and Objectives?

At this time some of the goals and objectives for framework formulation are not as clear as they need to be, and that is part of the reason for holding public meetings. There is diversity of outlook among interest groups regarding the future uses of the Lake Michigan shoreline. Opinions differ as to whether power

plants should be required to have cooling towers. There are varying goals and objectives with respect to the role of commercial navigation and the depths of ports and channels in the Great Lakes Basin. There are differences of opinion concerning the speed and magnitude of water quality investment programs to be undertaken. These differences of opinion include such controversial subjects as phosphates in detergents, waste disposal methods, and the need for treatment of combined sewage and storm water flows. Planners need answers to these questions. What answers do you suggest?

Industrial firms asked that we use the basin's natural advantages to make commercial navigation more competitive in the Lake Michigan basin in comparison with other regions of the country. Others have asked that planning encourage expansion of transportation facilities to better accommodate marketing of industrial products and movement of people.

Many of the upper Lake Michigan basin's residents have incomes below national and basin averages. Planning Subareas 2.1 and 2.4 incomes are about 20 percent below national average. There are some opportunities for water and related land resources development to alleviate this problem, but planning for water and related land resources development, on a long-term basis, can generally help only in a limited way.

Over the past several decades, some portions of the lower Lake Michigan basin have had incomes somewhat lower than the national average; however, the basin's per capita income is projected to move closer to the national average. Provision for adequate outdoor recreation opportunities, wildlife experiences, and use of aesthetic and cultural opportunities is important for balanced regional development.

There is a need to plan programs to supply jobs which will provide livelihood to basin residents. Such jobs should be diversified and enable all sections of the population to work together to enhance the quality of life for all.

There are many special groups in the Lake Michigan basin which have expressed concern over enhancing and maintaining environmental values in their areas. They are concerned that government is not making funds available in amounts adequate to accomplish their preservation objectives.

Most respondents to the questionnaire of the Framework Study Interim Report indicated that reduction of pollution and overcrowding and adoption of better land use policies and practices were favored objectives.

Concepts of Growth

The Framework Study has looked at three alternative growth rates for the future in the Lake Michigan basin. Future growth means changes over the next fifty years in population, income, and employment levels from what we experience today. These complex growth changes, also called projections, provide a base upon which environmental resource demands are calculated. Each of the following three growth concepts means meeting different levels of water and land resource demands.

- NORMAL GROWTH RATE

  This level of development is associated with objectives of national economic development and based primarily on projections of the historical trends of population and resource demands. It represents a middle-ground approach to growth, but one which is slightly higher than present projections of anticipated growth.

- ACCELERATED GROWTH RATE

  This is the level of growth associated with maximum possible economic, demographic, and per capita demand increases. It assumes that regional development is of primary importance and will increase above the national economic development level in order to promote economic development at the expense of some other area of the country. This level projects an increased willingness to exploit natural resources

and to relegate cultural, aesthetic and environmental factors to a position of secondary importance. An emphasis on structural alternatives for resources management is implied.

- LIMITED GROWTH RATE

  This is the level of growth characterized by a minimum level of population growth and minimization of per-capita demands for resources. It is based on the concept that preservation and restoration of the natural environment are of primary importance. A heavy emphasis on the natural, cultural, and aesthetic aspects of resource management is implied. Population is projected on a base approaching zero population growth, and unit demands for energy, goods, and services relative to the normal growth level are substantially reduced and assumed to level off over the projected period.

What would each growth rate mean for population, income and jobs in the Lake Michigan basin?

The table which follows illustrates that under normal growth, population will nearly double over the next fifty years. Under accelerated growth, population will almost triple. Under limited growth, a small increase in population is projected. Alternative projects for future income and jobs in the basin follow similar trends.

POPULATION
1,000 Persons

	PSA 2.1	2.2	2.3	2.4	2.0
1970 population	1,005.0	9,492.8	2,522.6	496.5	13,516.9
Normal Growth					
1980	1,082.2	10,999.0	2,914.0	546.8	15,542.0
2000	1,357.6	13,844.4	3,771.8	671.4	19,645.2
2020	1,726.0	17,385.8	4,876.4	841.7	24,829.9
Accelerated Growth					
1980	1,168.8	12,002.4	3,212.5	642.5	17,036.3
2000	1,808.8	16,833.9	4,714.4	980.5	24,337.6
2020	2,961.3	26,020.2	7,601.7	16,531.1	38,236.3
Limited Growth					
1980	944.8	10,050.7	2,665.0	501.7	14,162.2
2000	1,086.2	11,036.7	3,010.4	543.1	15,676.4
2020	1,194.9	11,941.1	3,359.5	583.7	17,087.2

Planning Focus on Normal Growth

Although the present work of the Basin Commission focuses on normal growth, examples of two other alternatives are included in this report for your review and reaction. The Commission wants your reaction to these alternatives to finalize their work.

Future Resource Needs

Many of the resource needs of people have been quantified in the table, Future Water and Related Land Needs and Opportunities, which follows. These, plus identified resources problems and defined objectives, serve as the benchmarks for future planning.

Questions and Choices

Here are some questions you might consider and respond to at the public meetings:

- Should government develop policies to regulate population growth? What policy should be used in deciding population levels in the Lake Michigan basin and in other parts of the Great Lakes Basin.
- What types of water and related land resources developments might help achieve agreed-upon population levels?
- Should policies or regulations be used to influence per capita use of the resources?
- Should incentives or penalties be used to decrease use of natural resources?
- Which resource problem do you consider to be of highest priority?
- What price are you prepared to pay to alleviate it?

More questions for your response at the public meetings relate to the types of programs selected and the extent to which these programs meet all of your needs and problems. Some examples of such questions are:

- What is your stand on the issue of power plant construction and siting?
- To which basic objectives do you ascribe?

LAKE MICHIGAN BASIN

FUTURE WATER AND RELATED LAND NEEDS AND OPPORTUNITIES

NORMAL FRAMEWORK

Resource Use Categories	Units	Needs and Opportunities[1] Base Year (1970) to 1980	2000	2020
WATER WITHDRAWALS				
Municipally Supplied	mgd	478.6	1400.7	2593.7
Self-Supplied Industrial	mgd	585.0	2188.0	4771.5
Rural Domestic & Livestock	mgd	30.9	88.5	127.7
Irrigation	mgd	465.5	884.2	1339.6
Mining	mgd	39.4	111.1	246.4
Thermal Power Cooling	mgd	2875.3	16725.1	42180.8
NON-WITHDRAWAL WATER USES				
Mun. Wastewater Discharges	mgd[2]	964.5	1453.1	2168.6
Ind. Wastewater Discharges	mgd[2]	3313.5	3129.8	5089.3
Hydroelectric Power	mgd	47309	47309	47309
Water-Oriented Outdoor	1000 recreation days	49095	94194	154298
Recreation	1000 acres W.S.	NA	NA	NA
Sport Fishing	1000 angler days	10547	20533	30689
	1000 acres W.S.	NA	NA	NA
Recreational Boating	1000 boat days	3642	8382	14520
	1000 acres W.S.[3]	1759.2	1759.2	1759.2
Commercial Fishing	million tons/yr.	NA	NA	NA
Commercial Navigation	million tons/yr.	110.8	150.9	195.9
RELATED LAND USES & PROBLEMS				
Agricultural Land--Treatment	1000 acres[3]	8953.1	8953.1	8953.1
--Cropland Drainage	1000 acres[3]	1519.0	1519.0	1519.0
Forest Land--Treatment	1000 acres[3]	9051	9051	9051
Shoreland Erosion	miles	586.9	586.9	586.9
Streambank Erosion	miles	3769	3769	3769
	$1000 Avg. Ann. Damages	411.9	411.9	411.9
Flood Plains--Urban	1000 acres	74.6	78.5	83.2
--Urban	$1000 Avg. Ann. Damages	20329.3	40688.9	83482.8
--Rural	1000 acres	1095.9	1091.9	1087.4
--Rural	$1000 Avg. Ann. Damages	4583.4	5662.2	6555.0
Wildlife Management	1000 acres	1708.6	4527.0	7973.4
	1000 user days	7088.4	10945.4	14647.4
Aesthetic & Cultural	1000 acres	NA	NA	NA
Outdoor Rec.--Intensive	1000 acres	14.9	31.6	55.3
--Extensive	1000 acres	87.6	182.5	316.7

[1] Additional resource requirements and opportunities beyond 1970 requirements

[2] Total treatment requirement at each time period ([1] does not apply)

[3] Opportunities

- In the interest of regional economic development, it might be desirable to ease recent restrictions on power plant siting and let the power plant construction proceed. In this regard some thermal loadings might be incurred with the determination that the regional economic gains warrant the risk of adverse effects that may accrue to the environment. From another view, all power plant siting might be deferred until all beneficial and adverse environmental effects of locating a particular plant have been completely discerned and resolved. Are you willing to accept brown-outs and black-outs due to power shortages? Are you willing to reverse present patterns of power use? Should the States select and reserve needed power plant sites?

- Regarding municipal and industrial waste treatment, a national economic development framework would call for waste treatment to be accomplished in conventional treatment plants. Would net environmental values be gained through transporting treated wastewater and using it on the land to assure that the land stays in a relatively low density use? Is the transport of waste and disposal on land environmentally desirable? Is this means of waste water disposal with its substantial land requirements socially and economically acceptable?

- In planning for recreation, there are a few locations in the Lake Michigan basin where some options exist between the development of special or multiple-purpose reservoirs and maintaining a stream valley in its natural state. Which do you want in your area?

PROGRAMS FOR NORMAL GROWTH AND SOME ALTERNATIVES

The following are more detailed Lake Michigan programs suggested as guides for water and related land resources development over the next 50 years. Included in the discussion are brief presentations on how needs and problems can be met on a short-term and long-range basis as well as the price tag associated with these programs. Also included is a brief resume of what some of the issues may be. Furnish us your opinion of these programs at the public meetings.

Water Quality

By the year 2020, the amount of municipal wastes needing treatment will triple. In just 50 years, then, sufficient facilities will be required to treat a total of about 2,170 million gallons of municipal waste every day. Programs which characterize the normal framework for the entire Lake Michigan basin are designed to meet water quality standards and to meet the conditions and time schedules for water pollution abatement that resulted from Enforcement Conferences held on Lake Michigan from 1965 to the present time. Future programs will also provide for nondegradation of water where an existing level of water quality is higher than the water quality standards.

The normal framework program to meet water quality standards throughout the entire Lake Michigan basin will generally provide a minimum level of secondary waste treatment to remove a large part of the organic material (at least 90 percent) and about 80 percent of the phosphates in municipal waste. Some municipalities are required by the States of Indiana, Wisconsin, and Michigan to provide tertiary treatment facilities and/or to accomplish greater than 80 percent removal of phosphates.

Advanced municipal wastewater treatment facilities, where required, are part of the normal framework. This would include a total of 13 locations by 1980, twelve in Michigan and one in Indiana. By 2020, there would be a total of nine locations in Indiana and fifteen in Michigan requiring advanced treatment facilities. The normal framework does include costs for advanced wastewater treatment for all the States adjacent to Lake Michigan.

At present, specific programs or costs are not included in the normal framework relating to: (1) separation of combined sewers; (2) provision for additional tertiary treatment facilities; nor (3) extension or upgrading of collection sewers for currently sewered municipalities. An estimate of the cost of accomplishing such programs is not now available, but it is certain that such programs would be very expensive. It should be noted that some communities are or will be providing planning for these programs in the future.

Programs for agricultural waste treatment are not included. Again, because of the relationships of these programs to the nutrient level, further studies will need to be made.

A limited growth framework could include the adoption of laws severely limiting any discharging of pollutants into any of the tributary streams or to Lake Michigan itself. A limited growth framework for water quality enhancement might well result in a number of industries in the Lake Michigan basin locating elsewhere. This study does not quantitatively evaluate the possible effects on the basin's economy of industry relocation. Also, although the adoption of the accelerated growth objective could endorse relaxed water quality standards which would be an inducement to industries to locate or remain in the Lake Michigan basin, such an objective has not been deemed to be in the best interest of the users of the waters in the basin. Perhaps the greatest difference

between an accelerated growth objective and a normal growth objective would be reflected in a somewhat delayed program for meeting water quality standards in the accelerated growth framework.

The normal framework does not include a recommendation to limit the phosphate contents of detergents, although legislation to that effect has been adopted in some of the Great Lakes Basin States and in numerous Basin communities. Continued research for development of nonphosphate detergents is included as a program in the normal growth framework.

The United States and Canada have recently consummated the Executive Agreement for Water Quality in the Great Lakes which outlines programs and schedules for the accomplishment of water quality objectives. There are some programs called for in the Agreement which have not been included in the normal growth framework. However, work is continuing to quantify the cost of implementing these programs, and it is expected that the Commission's proposed framework will be consistent with the Executive Agreement.

Proposed Outcomes:

- Water quality standards and the uses related thereto will be met and upgraded wherever possible.
- There will be no degradation of water quality below existing levels.

Price Tag:

- Slightly over $965 million by 1980, to treat municipal wastes only, estimated 65 percent Federal, 35 percent non-Federal (pending legislation).
- About $4.5 billion over the next 50 years for meeting municipal wastewater treatment requirements.

Major Issues:

- Should a program for complete treatment of combined sewer overflow of storm water be included in the proposed framework?

- Considering the serious state of some localized portions of Lake Michigan, should a policy of no-discharge of pollutants be implemented throughout the entire basin area regardless of the potential resultant economic and secondary environmental impacts? Should manpower be made available to monitor and ensure that this condition is satisfied? Should governmental support be available for industrial adjustment?

- Should agricultural wastes be managed throughout the entire Lake basin? How? By an intensified program of land treatment and regulation with respect to agricultural land use? By a program of actually catching the wastes and treating them before their discharge to the tributaries to Lake Michigan?

- Should there be more emphasis by government on strategies to reduce demand on natural resources for goods and services so as to reduce volumes of wastewater needing treatment?

Outdoor Recreation

The combining forces of an intense recreation demand and a general shortage of recreational opportunities make it nearly impossible to satisfy future recreational needs in the southern half of the Great Lakes Basin. Normal framework programs will have satisfied only about 60 percent of the needs by 1980 and about 50 percent by 2020 in the lower portion of the Basin. A tentative conclusion reached is: In the normal framework the unmet recreational needs must be met in the upper part of the Great Lakes Basin or remain unsatisfied, if other basins are not encouraged to provide additional facilities.

There are needs in some localities for further development of local, county, and State recreation areas. However, the greatest need is for development of the already proposed or authorized recreation areas of national significance. The normal framework indicates a need for further development of such areas as the North Country Trail through part of the basin; the Sleeping Bear Dunes National Lakeshore, the Indiana Dunes National Lakeshore, with development of National and State forests for intensive recreational use, further regional parks and acquisition and development of river valleys. In the northern portion of the Lake Michigan basin the development of these recreation areas and many others in the area would enhance the tourist trade and assist in developing the economically distressed area. New State parks are projected in the normal framework for the years 2000 and 2020 as well as increased management and development for public use of the shores of Lake Michigan.

Despite the rather extensive recreation resources of the northern half of Lake Michigan basin to meet projected outdoor recreation needs from other parts of the Basin and the Nation, a long-range plan of development will be needed.

Proposed Outcomes:

- satisfaction of about 50% projected recreation-day and land needs by 2020
- development of proposed and authorized areas to meet future recreation needs from within and outside the basin
- acquisition of the prime areas for recreational development

Price Tag:

- short-range program to 1980, $265 million

- mid-range program 1980 to 2000, $536 million
- long-range program 2000 to 2020, $687 million

Major Issues:

- Should all prime recreational land and shoreline land be acquired for public recreational use in a framework for the Lake Michigan basin?
- Should the framework attempt to satisfy only the needs generated within this basin, or should Federal and State programs be accelerated to encourage the tourist trade and recreational visitors in the northern half of the basin from outside the area?
- Should larger and better highways be provided particularly in the northern half of the basin to make these areas available to out-basin visitors? (The Framework Study does not quantify programs and costs for highways.)

Sport Fishing

Future fish management programs would provide for the additional development of cold-water and some warm-water fishing opportunities. The normal growth framework includes programs to provide the opportunity in the Lake Michigan basin for an additional 7,509,000 angler days annually by 1980 and an additional 25,408,000 angler days annually by 2020.

Additional public access for fishing in all four States of the basin, improvement of habitat, fish production, and fish planting are planned. Some public acquisition is also part of the normal growth framework. A sustained and adequate program of sea lamprey control for the Great Lakes including Lake Michigan is in the normal framework.

Proposed Outcomes:

- The normal framework satisfies over 90 percent of the projected angler-day needs for the respective time periods.
- Anadromous fishery is increased over that presently available.
- The best opportunities for fishery management and enhancement of inland waters are included.

Price Tag:

- short-range program to 1980, $17.4 million (Illinois not available)
- mid-range programs 1980-2000, $26.2 million (Illinois not available)
- long-range program 2000 to 2020, 42.3 million (Illinois not available)

Major Issues:

- Should enhancement of cold-water fishing opportunities be given a higher priority than providing additional warm-water fishing opportunities?
- Should fish management programs in northern Lake Michigan basin be accelerated to increase the tourist trade?
- Should water quality be upgraded so that it has no constraint at all on any species availability in any of the waters in the Lake Michigan basin?
- Should an attempt be made to establish a balance between sport and commercial fishing or should the present emphasis on sport fishing be maintained? Should programs be implemented and included in the framework to bring about such a shift?

Land Management and Conservation

Some 12,596,200 acres, or 39 percent, of the Lake Michigan basin are forested. It is estimated that out of this total forest acreage, composed of Federal, State, county, and private lands,

9,051,000 acres require some sort of treatment or improved practices. A forest land treatment program has been proposed in the normal framework to control erosion, provide wildlife habitat, reforestation and stand improvement, and enhance environmental values. This program would provide treatment for 980,700 acres between now and 1980, on an additional 1,954,700 acres between 1980 and 2000, and an additional 1,923,000 acres up to 2020. Approximately one-third of the acreage to be treated is included in the present ongoing programs of the Federal and State forestry programs. By 2020, forest land treatment would have been provided on about 54 percent of the total forest land which could benefit from treatment in the Lake Michigan basin. Eighty-seven percent of the total forest land treatment programs for the Lake Michigan basin is divided almost equally between Planning Subareas 2.1 and 2.4.

Agricultural land consisting of cropland, pasture land, and other land has been inventoried in this study. About 8,952,900 acres, or about 26 percent of the total land in the Lake Michigan basin, would benefit from applied conservation practices to reduce soil losses now and in the future. The agricultural land treatment included in the normal growth framework represents a continuation of past conservation program levels. This means:

- about 730,400 acres would receive agricultural land treatment in the next ten years
- an additional 1,460,800 acres between 1980 and 2000
- an additional 866,100 acres between 2000 and 2020

By 2020, about 34 percent of the land needs would have received such treatment in the normal growth framework.

Drainage of cropland will improve the productive capacity of these lands. Drainage programs reflect a continuation of on-farm drainage and include tiling, ditching, and other field drainage measures. The normal framework for the Lake Michigan basin provides cropland drainage for 141,900 acres between present time and 1980, an additional 54,400 acres between 1980 and 2000, and 178,800 between 2000 and 2020.

Recommendations for inventory, analyses, management, development, and preservation of the Lake Michigan shoreline consisting of 1362 miles in four States are part of the normal framework. Wisconsin and Michigan have recent legislation for shoreland management with local option. In the normal framework, shoreline erosion measures are presented to treat 130 miles of critical erosion over a 50-year period. Generally speaking, the program treats 20 percent of the critical reaches in the early action period, 40 percent in the middle-range period, and the remaining 40 percent of critical reaches in the period 2000 to 2020. The normal framework does not provide protection measures on any of the 457 miles subject to non-critical erosion, as management to prevent increased damages is assumed for these areas.

An accelerated growth framework anticipates higher levels of residential and commercial development along the shores of the Great Lakes. It provides for treating all of the critical erosion earlier in the planning time period than the normal framework. It also provides for treatment of non-critical erosion reaches in the interest of enhancing the residential and commercial development cited above.

The limited growth framework shows less pressure on the shoreline for residential and commercial use and emphasizes the overriding o objective of preserving the shoreline for the benefit of future generations with much more of it available for public use. In this framework, each individual reach would be scrutinized; and, based on the aesthetics involved, a decision would be made as to whether to provide erosion abatement for that particular reach. It is expected that this would be a level of shoreline erosion abatement somewhat below the normal growth level.

The normal framework also provides for a modest program of streambank erosion protection for severe problem reaches over a 50-year period. More than 223 miles of streambank protective measures would be programmed through 1980; an additional 1118 miles would be treated by 2020. About 30 percent of the total bank mileage subject to streambank erosion would be corrected in normal framework proposals.

Because resource uses are hampered by high sediment loads, primarily from streams tributary to the southern portion of Lake Michigan, it is expected that a limited growth framework would include a substantially larger program of streambank erosion abatement. It is likely that a limited growth framework would also have a higher level of streambank protection than would the accelerated framework. The program of streambank erosion abatement is intensified over the normal framework in the interest of accelerated growth. The protected land uses along the streambank would enhance the economic gains and minimize the losses if such programs were implemented.

Proposed Outcomes:

- sediment reduction, erosion control, and improvement of plant cover on agricultural and forest lands
- improved crop production on 375,100 acres through on-farm drainage measures by 2020
- correction of the critical erosion problems identified along the shoreline of Lake Michigan
- correction of the most severe streambank erosion reaches

Price Tag:

LAND MANAGEMENT AND CONSERVATION PROGRAMS

	Cost per Period ($ million)		
	Short-Range	Mid-Range	Long-Range
• Forest Land Treatment	41.9	92.1	95.5
• Agricultural Land Treatment	30.1	64.8	45.2
• Cropland Drainage	35.1	21.3	47.0
• Lake Michigan Shore Protection	14.6	37.2	47.9
• Streambank Erosion Control	8.0	20.6	26.7

Major Issues:

- Should government develop strategies to protect prime agricultural land from expanding urban and transportation uses?

- Should streambank and shoreline erosion protection programs be accomplished sooner for critical reaches than suggested in the normal framework?

Commercial Navigation

Numerous ongoing studies are addressing many of the problems associated with structural and operational changes in the Great Lakes-St. Lawrence navigation system. These include studies concerning the extension of the navigation season, provision for additional locks and canals in the seaway system, and increased channel depths and widths to accommodate supercarriers.

The normal framework does not include specific recommendations for the extension of the Great Lakes navigation season other than support for the current study by the Army Corps of Engineers. The framework calls for full participation by other agencies and for necessary funds to be allocated for prompt completion of the study. It would support the continuation of the current program to provide for containment of all polluted dredged spoil and maintenance of the existing system of harbors and connecting channels.

Alternatives

One alternative would be to provide facilities for vessels up to 1000 feet long, 105-foot beam, requiring channel depths of 31 feet. Because the navigation system in the Great Lakes requires comparably improved facilities at harbors, connecting channels, and at locks and canals before movements between Lakes or through the system are possible, the costs of common facilities between Lakes must be prorated among harbors and individual Lakes. The following table furnishes information on such facilities:

COSTS FOR 31-FOOT DEPTHS

($ million)

	Facility and Cost		
Lake Michigan Basin	Dredging	Docks	Total
Milwaukee	25.1	29.2	54.3
Calumet	53.0	2.2	55.2
Chicago	0.6	0.2	0.8
Indiana	11.2	--	11.2
Escanaba	0.6	--	0.6
Total--Lake Michigan Harbors	90.5	31.6	122.1

Other System Facilities	
Sault Ste. Marie Locks	46.0
St. Clair Dam and Lock	57.0
Other Harbors	307.0
Channels	707.0
Other Harbor Structures	31.3
Lakes Ontario-Erie Canal	1,408.0
St. Lawrence Seaway:	
Locks	498.0
Dredging	412.0
TOTAL (to be included in Great Lakes only once)	3,466.3

Under the limited development objective, further navigation improvements would not be recommended.

Proposed Outcome:

- Support for the continuation of current programs to provide for containment of all polluted dredged spoil and maintenance of the existing system of harbors and connecting channels. Additional programs for meeting normal growth framework objectives subject to further study.

Price Tag:

- short-range program to 1980 (no additional cost above existing programs)
- mid-range program 1980 to 2000 (no additional cost above existing programs)
- long-range program 2000 to 2020 (no additional cost above existing programs)

Major Issues:

- In the interest of further development of waterborne commerce in the Lake Michigan basin, should the existing 27-foot channel and harbor depths be deepened to 31 feet? 32 feet? 34 feet?
- Do you favor a 12-month navigation season? Why?
- Enlarging the Great Lakes navigation system would economically benefit the Lake Michigan area, but are the costs justified? How?

Recreational Boating

Lake Michigan boating provides good recreational experiences, although smaller craft have limited opportunities due to the potential adverse weather conditions. Lake Michigan bays and inland lakes provide fishing and hunting opportunities. Boating access and facilities would also promote tourist trade and growth of the economy, particularly where such economic growth would be desirable in the northern portion of Lake Michigan subbasin. Harbors of refuge, navigational aids, and weather service are necessary developments to the growth of recreational boating in Lake Michigan.

The normal growth framework would meet the growing boating demands of the non-resident population created by the increasing population of coho salmon and lake trout. The recreational boating program would provide for an increase of access and facilities for an additional annual 3,642,000 boat days of use by 1980, 2,942,000 boat days between 1980 and 2000, and 5,010,000 additional annual boat days from 2000 to 2020.

Proposed Outcomes:

- satisfaction of projected boat days by creating new facilities and access but would require local sharing of costs
- increased navigational aids and weather forecast service
- provision for development of prime areas for boating

Price Tag:

- short-range program to 1980, $239 million (about 40 percent Federal, 60 percent non-Federal)
- mid-range program 1980 to 2000, $502 million
- long-range program 2000 to 2020, $853 million

Major Issues:

- Should the framework attempt to satisfy only the needs generated within this basin, or should Federal and State programs be accelerated to encourage the tourist trade and recreational visitors from outside the area?
- What facilities should be considered for the boating recreationist? For the fisherman and hunter?

Wildlife

The normal growth framework includes programs to provide additional opportunities for hunting or simply observing wildlife above the 1970 levels. By 1980 these would provide people with 7,088,400 occasions of wildlife-oriented activities. (These are called "user days" by planners.) The normal framework also provides for about double that amount between 1980 and 2020. (Planners use the term "wildlife use" to mean hunting, birdwatching and animal watching, and hiking for purposes related to wildlife habitat. They consider hunting to be a consumptive use and birdwatching to be a nonconsumptive use of wildlife.)

In the Wisconsin portion of Planning Subareas 2.1 and 2.2, new programs are proposed to supplement ongoing budgeted programs by State agencies for habitat management, enforcement, and research. They include:

- treatment through prescribed burns, bulldozing and shearing timber, seeding logging roads and clearings, aspen regeneration, wildlife cover on diverted cropland
- acquisition of deer wintering areas, developing trails, restoring lakes and streams
- subsidizing forestry practices, wildlife surveys, and environmental impact studies
- legislation for management of endangered species and public hunting leases
- intensive management of low-yield hardwood areas

In the Michigan section of Planning Subarea 2.1, as well as 2.3 and 2.4, additional programs in the normal growth framework are:

- deeryard and wetlands acquisition
- wetlands development and restocking some endangered species
- additional law enforcement and wildlife user training
- information and ecology training centers
- Canada goose release program in 2.3

In the Indiana portion of 2.2 and 2.3, additional programs involved in the normal growth framework include:

- some acquisition of natural streams
- wetland acquisition
- additional hunter access
- acquisition and development of additional fish and wildlife areas

Proposed Outcomes:

- Programs satisfy 50 percent of projected wildlife user-day needs, but acreage requirements will fall far short.
- The framework provides for a number of management programs to be continued and to be increased in the interest of enhancing wildlife opportunities.

Price Tag:

- short-range program to 1980, $33.0 million (Illinois values not available)
- mid-range program from 1980 to 2000, $55.5 million (Illinois values not available)
- long-range program from 2000 to 2020, $49.1 million (Illinois values not available)

Major Issues:

- Should additional acreage for wildlife habitat be provided in the Lake Michigan basin?
- Additional acreage should be designated for wildlife habitat management as its primary use. Agree?
- Should the framework include increased land acquisition, particularly along shorelines and marsh areas?

Water Supply

In the normal framework, about 5483 million gallons of water per day for municipalities, rural areas, and self-supplied industry in addition to those now provided are estimated to be needed by the end of the next half century to meet the demands of an increasing Lake Michigan area population and its growing economy. Over 42,200 million gallons per day of additional diversions for thermal power cooling purposes would be required. However, it should be noted that most of this water is returned to the source after use. Generally, additional quantities for rural and domestic uses are limited due to poor groundwater conditions.

The large portion of water supplies for municipally supplied systems and self-supplied industry as well as the electric power industry will come from Lake Michigan. The smaller inland municipalities and the rural domestic water supplies are mainly supplied by groundwater. The normal framework includes programs to satisfy 100 percent of the needs for each of the time periods 1980, 2000, and 2020.

Alternatives

Indications are that a shift from normal growth projections to accelerated growth projections with resultant increased needs would probably bring about an even greater dependence on Lake Michigan as a source of withdrawal. In addition, if programs are not implemented to have any effect on the per capita consumption of water, it is expected that the needs for water withdrawals will be higher.

If limited growth objectives were to be achieved (including both lower levels of population and less per capita consumption), there would be a decrease in dependence on Lake Michigan as a source of water--and less capital investment would be required.

In Planning Subareas 2.1, 2.2, 2.3, and 2.4 water resources are generally adequate to meet an accelerated growth objective. An under-average economy in two of the four planning subareas could be substantially boosted through emphasis on accelerated industrial, employment, and population growth.

Proposed Outcomes:

- high quality water for all major uses through 2020
- 100 percent of needs satisfied for normal growth conditions

Price Tag:

- short-range to 1980, $283 million (excluding distribution costs) to meet new and additional water supply needs for municipalities and rural domestic (30 percent Federal, 70 percent non-Federal)
- long-range needs to 2020, about $2963 million.

Major Issues:

- In large urban areas, increasing dependence upon Lake Michigan implies greater costs for inland communities or large regional water supply systems with extensive distribution networks. Which is preferred--many small systems or a large regional system?
- Should government spend larger sums of money to develop water supplies to encourage business and industries to locate in the Lake Michigan area?

Flood Damage Prevention

The programs included in the normal growth framework do not eliminate all of the urban and rural flood damages, nor do they protect all urban and rural flood plains subject to such damage. There are some opportunities for flood protection and reduction in the Lake Michigan basin as a result of structural improvements, such as levees and dams. Emphasis is placed on reducing flooding damages through management and legislative means.

In the Lake Michigan basin, Michigan, Wisconsin, and Indiana have enacted floodway encroachment laws. Normal growth programs include flood plain regulations which would reduce flood and property damages as well as improve safety and social well-being. The adoption of such laws represents a realization that a shift from local rule to some State statutory action is necessary if flood damages are to be eliminated effectively and life protected.

For the normal framework, some watershed and flood prevention measures in terms of channel modifications and small reservoirs are desirable for parts of River Basin Groups 2.1, 2.2, 2.3 and 2.4. Levees, floodwalls and other local protective works are considered in the near term for Little Calumet River, Indiana, Mishawaka and Three Rivers on St. Joseph River in Indiana, and Grandville on Grand River in Michigan. On a long-term basis, the normal framework includes similar structural measures to reduce flooding damages for Manitowoc, Sheboygan, and Milwaukee Rivers in Wisconsin and at Niles, South Bend, and Elkhart, Indiana, in the St. Joseph River basin.

Proposed Outcomes:

- A Lake basin-wide program of flood plain encroachment laws and regulations would be implemented.

- Estimated urban average annual damages would be reduced by 92 percent by 2020 through management and some structural measures; rural average annual damages would be reduced by about 36 percent by 2020.

Price Tag:

- Short-range costs to 1980 would be about $148 million for structural programs (Flood plain management costs are not estimated.)

- Long-range estimated costs to 2020 would be about $261 million for protective measures.

Major Issues:

- Should flood plain regulation be implemented and enforced at the State level rather than at the local governmental level?

- In light of the opportunities of using river valleys for other purposes, should large sums of money be allocated to the acquisition of flood plains?

- Should additional flood protection be provided in urban areas so that existing urban development can remain on the flood plain, thereby providing more economic opportunities where the people currently live?

- Stream modifications in urban and rural flood plains may create wildlife habitat conflicts. Long-range improvements for flood damage prevention, cropland drainage and wildlife resources justify temporary disruption of some stream reaches. Agree?

Program Summary

The estimated price tags of resource programs in the following table can serve as guides for future water and related land resource development and management under normal growth objectives. The Great Lakes Basin Commission is still developing some of the program elements of the normal framework. The normal framework represents only one alternative for managing natural resources to meet people's needs. Examples of accelerated growth and limited growth programs have been included throughout this booklet to help generate discussion and public expression on the content of the Great Lakes Basin Commission's normal and proposed frameworks which will be refined after the public meetings. Your opinions will help shape the Commission's final conclusions.

We look forward to your help in this important task.

Lake Michigan Basin

NORMAL FRAMEWORK: ESTIMATED COST SUMMARY

Framework Program Categories	Framework Cost[1] ($millions) 1970 to 1980	2000	2020
• Water Supply	283.4[2]	1252.9[2]	3548.8[2]
• Pollution Control			
- Municipal Wastes	965.4	2490.5	4545.0
• Flood Damage Prevention	147.5	223.0	261.2
• Outdoor Recreation			
- Water-Oriented, non-boating	264.7	836.8	1523.6
- Boating	239.1	741.0	1594.2
• Land Conservation and Management			
- Lake Michigan Shore Erosion Control	14.6	51.9	99.8
- Streambank Erosion Control	8.0	28.6	55.3
- Cropland Drainage	35.1	56.4	103.4
- Agricultural Land Treatment	30.1	94.9	140.1
- Forest Land Treatment	41.9	134.0	229.5
• Wildlife Management	33.0[3]	88.2[3]	137.4[3]
• Commercial Navigation	51.0	210.7	238.9
• Sport Fishery	17.4[3]	43.6[3]	85.9[3]

[1] Preliminary estimates of capital plus operation, maintenance, and replacement costs

[2] For municipally supplied and rural domestic water supplies only

[3] Partial costs at this time

The Great Lakes Basin Commission thanks its public meeting co-sponsors across the Basin:

Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin

League of Women Voters (Lake Erie Basin Committee), Northeast Ohio Advisory Council, Lake Erie Watershed Conservation Foundation, Three Rivers Coordinating Council, Northwest Pennsylvania Resource Planning and Development Commission, Arrowhead Regional Development Commission, Southeast Wisconsin Regional Planning Commission, Lake Michigan Federation, Northeastern Illinois Planning Commission, St. Clair County Board of Commissioners, and others

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